SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS

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Putting the San Joaquin to Work
Sending Photographs Over Wires
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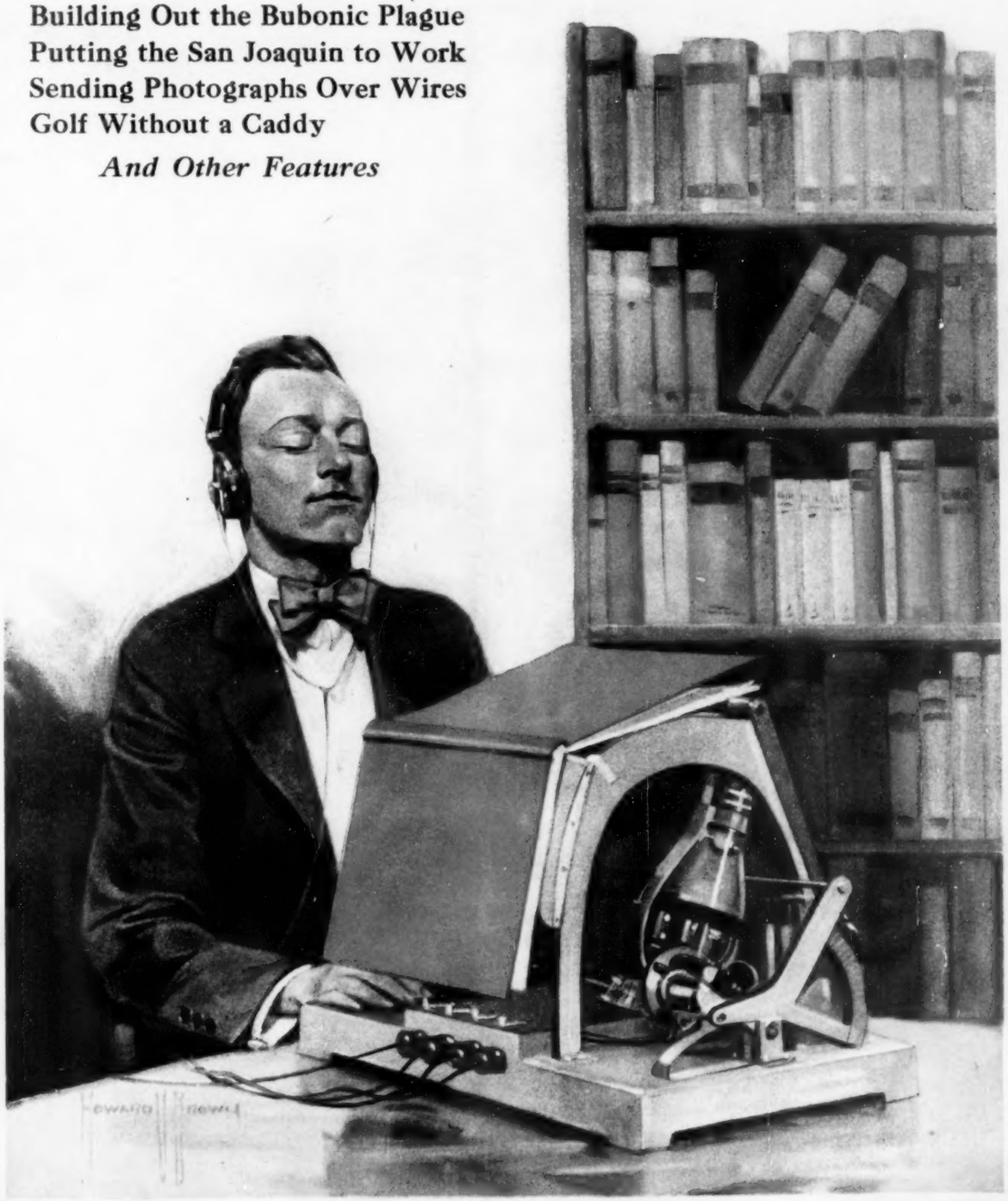

HOW THE BLIND MAY READ ALL BOOKS BY MEANS OF THE OPTOPHONE.—[See page 463]

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"Built of the Best"

Davis is another motor car builder who has built success and reputation on proved units, each the product of a specialist in its particular line. In following out this policy the importance of the part played by front and rear axles—the support and final drive—was fully realized.

Timken-Detroit Axles, the result of twenty years of striving to build still better axles, will be found under the Davis, as well as under thirty-two other sturdy leaders in the American passenger car field.

Beggs	Essex	McFarlan	Shaw
Cadillac	Forster	Metz	Sheridan
Columbia	Geronimo	Moon	Singer
Crawford	Handley Knight	Noma	Standard Eight
Cunningham	Hanson	Pan-American	Stephens
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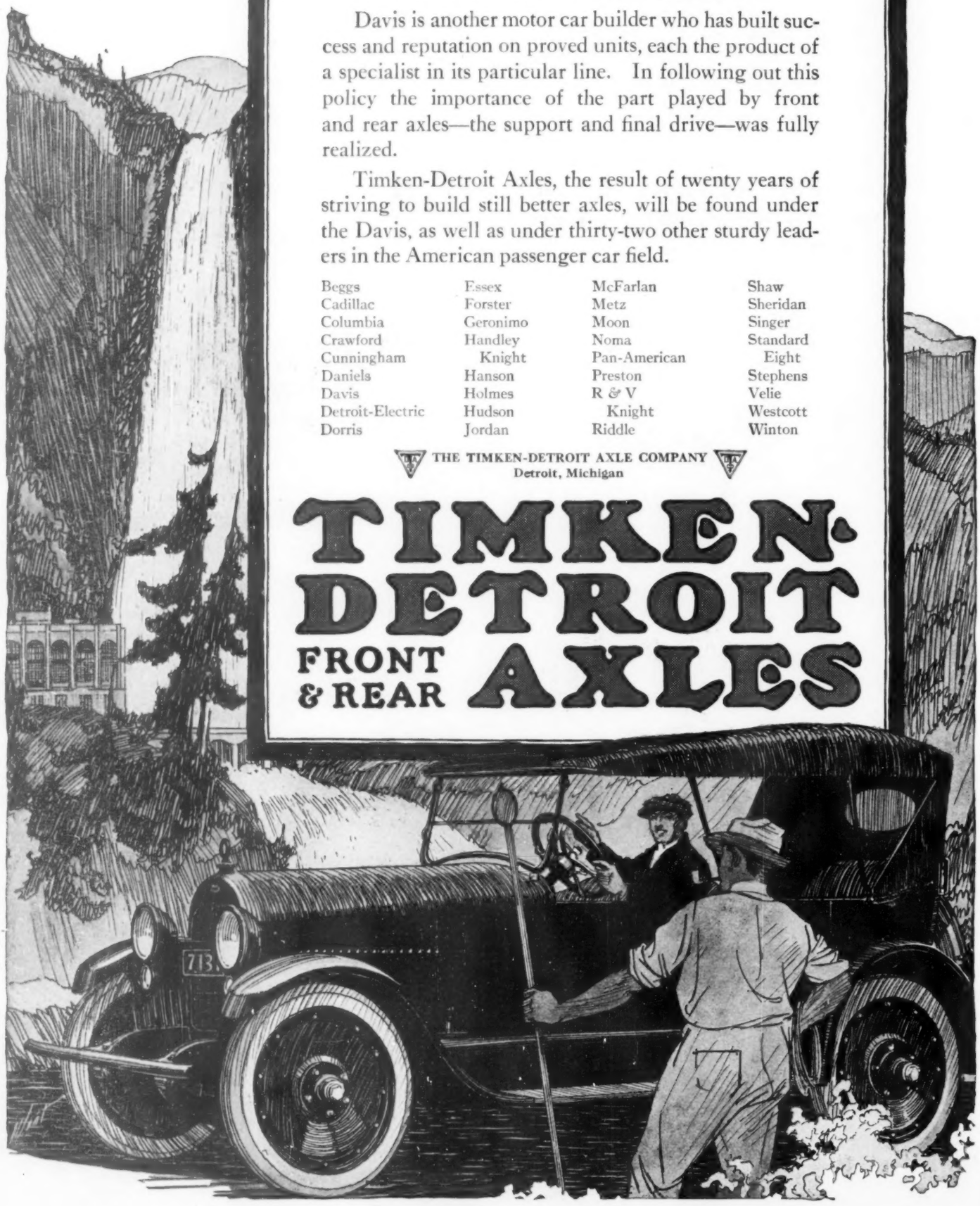
THE TIMKEN-DETROIT AXLE COMPANY
Detroit, Michigan

TIMKEN-DETROIT FRONT & REAR AXLES



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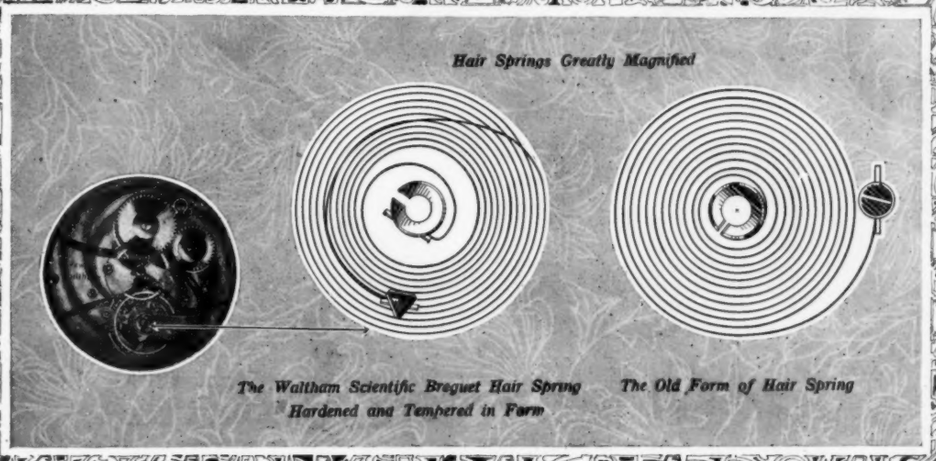

THE MOST SCIENTIFICALLY BUILT WATCH IN THE WORLD

The Waltham Scientific and Exclusive Process of Hardening and Tempering the Hair Spring in Form

THE Hair Spring is to the balance wheel of a watch what gravity is to the pendulum of a clock.

The Hair Spring is so extremely important in its mechanical functions that we affirm — a watch is only as good as its hair spring.

Therefore, the Hair Spring that most closely approximates perfection in the watch you buy gives you more value for your money as a time-keeper and as an appreciated investment.

The Waltham Hair Spring is the only Breguet Hair Spring in the world that is hardened and tempered in form.

In other words, the end of the unscientific hair spring is twisted into the Breguet shape *after* the spring is hardened and tempered.

Therefore, if this unscientific hair spring happened to be of *fine* steel temper, it would have to function under undue stresses.

What does this imply? That, sooner or later, the resiliency of such a spring *must* deteriorate, making the watch an erratic time-piece.

The genius of Waltham overcame this unknown factor of irregularity in the Hair Spring by inventing and patenting a process whereby the whole hair spring was shaped to its ultimate use *and kept in that perfect shape* while being hardened and tempered.

The over-coil called Breguet (after the name of its inventor) was a great invention of years ago, but it affected only the outer half of the spring. And, because of the Waltham scientific method of hardening and tempering in form, it became possible for Waltham to perfect and add an inner terminal bend which gives equal action to both ends of the spring.

This is a vital and exclusive Waltham invention.

It gives to a Waltham Watch a greater dependability and a closer precision. It has made the Waltham Watch the most sought after watch in the world. It gives to the buyer of a Waltham Watch a confidence that herein is the art of watchmaking at its highest development.

Last, but not least — the Waltham Scientific Hair Spring hardened and tempered in form is an *American invention,* exclusively Waltham —

An unanswerable argument why your watch selection should be a Waltham.

Waltham 7½ Ligne

The movement is actually smaller than a dime in diameter

$250 to $1,500 or more depending upon the case

This story is continued in a beautiful booklet in which you will find a liberal watch education. Sent free upon request. Waltham Watch Company, Waltham, Mass.

WALTHAM

THE WORLD'S WATCH OVER TIME

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SEVENTY-SIXTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIII. NUMBER 19] NEW YORK. NOVEMBER 6, 1920 [15 CENTS A COPY 20 CENTS IN CANADA

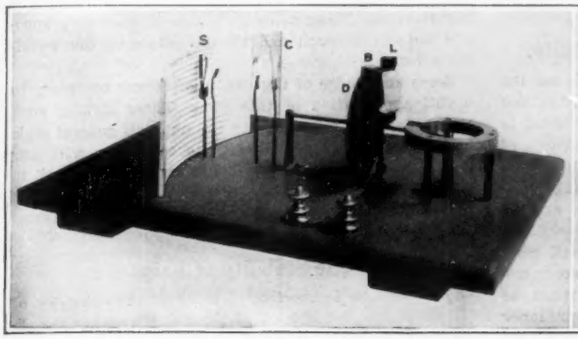

Fig. 1—Skeleton apparatus showing the principle of the "black-sounding" optophone

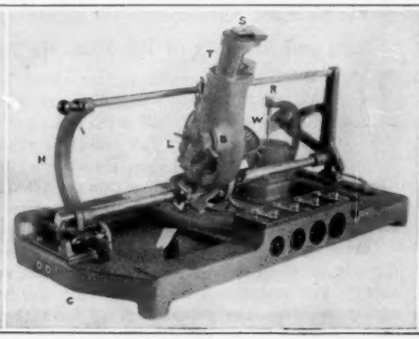

Fig. 2—The optophone with book rest removed, showing the "tracer" mechanism

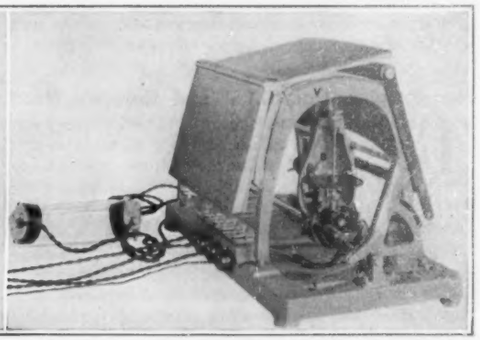

Fig. 3—The optophone complete with conventional book in place ready for reading

Simple and standard forms of optophone which enable the blind man, after some practice, to read type matter by means of sound

The Type-Reading Optophone

An Instrument Which Enables the Blind To Read Ordinary Type

IT would be difficult to conceive of a more remarkable electrical device than the type-reading optophone, which enables the blind to read ordinary type. This device, be it understood, is not altogether new as far as its basic principles are concerned. As far back as August 3rd, 1912, the SCIENTIFIC AMERICAN SUPPLEMENT carried a description of the first optophone which in its earliest form was an instrument for converting light into sound in such a manner that the blind were enabled to see by ear, so to speak.

The optophone was the invention of Dr. E. E. Fournier d'Albe of Birmingham University. Dr. d'Albe later developed a type-reading instrument by which the blind could read large print. Recently the instrument has been greatly improved in coöperation with Messrs. Barr and Stroud of Glasgow, the well-known instrument makers. In its present form it can be adjusted for any ordinary type, but it is well to direct attention to the fact that the blind person making use of the optophone must have a very fine musical ear in order to grasp the tone combinations emitted by the instrument and translate them into reading matter.

The general principle of the apparatus is shown in Fig. 1, wherein a siren disk, *D*, is run at about 30 revolutions a second by means of the small magneto-electric motor shown. It contains five circles of square perforations, the innermost circle having 24 perforations, the outermost 42, the other circles being intermediate and corresponding to the relative frequencies of certain notes of the diatonic scale. A line of light in a radial direction is provided by the straight-filament lamp *L*, and the image of the filament of this lamp is thrown upon the print by a system of three lenses on the other side of the selenium tablet *S*. The axis of the concavo-convex lens *C* is slightly tilted out of the axis of the other lenses for a purpose which is specified below. The general result of the optical system is to give a line of luminous dots on the print, each dot having a different musical frequency. The light constituting these dots is diffusely reflected back on to the selenium, which is put in circuit with a battery and a high-resistance telephone receiver. Those dots which fall on white paper produce a note of their own musical frequency in the telephone, while those which fall on black are extinguished, so to speak. We thus get what may be called a "white sounding" optophone, in which the black letters are read by the notes omitted from the scale rather than by the notes which remain sounding. All the reading demonstrations hitherto undertaken have been given with a "white-sounding" optophone, with the most satisfying results.

A modification of this principle, we learn from the SCIENTIFIC AMERICAN MONTHLY [successor to the SCIENTIFIC AMERICAN SUPPLEMENT] for October, has been introduced by Messrs. Barr and Stroud in consultation with Dr. d'Albe. This is the provision of a second selenium preparation in the form of a cylindrical rod, the top of which can be seen at *B*. This rod receives the light reflected by the concave surface of the lens *C*, which produces a real image of the line of dots on a generator of the cylindrical rod, and by turning this rod about its axis the image can be made more or less effective as desired. By balancing the effect on *B* against the effect on *S*, when white paper alone is exposed, a silence can be produced in the telephone, and the effect of the passage of a black letter is to make a sound which varies in accordance with the formation of the letter. This is the principle of what may be called a "black-sounding" optophone, and although its advantage over the "white-sounding" type has yet to be proved, there is little doubt that the learning of the alphabet sounded on the new principle will be easier.

The present construction adopted by Messrs. Barr and Stroud is shown in Fig. 2. Here the disk, lamp, lenses, and selenium, as well as the motor, are all mounted in the swinging "tracer," which can be brought over to the right by means of the reading-handle *H*. It then returns to the left with a slow, silent and steady motion regulated by the worm gearing *W*, which drives a small paddle inserted in a viscous liquid. This paddle can be inserted more or less deeply into the liquid by the regulating nut *R*, and such is the range of adjustment possible that a line can be read in anything from five seconds to five minutes, according to the proficiency of the reader. When the line is read, the next line is brought into focus by the change-bar *C*, which works a friction grip inside the bar on which the "tracer" is pivoted, and can be adjusted for any desired line space by means of the screw attached to the change bar. A lever attached to the "tracer" enables the operator to reverse this motion or to release the whole "tracer" from the friction gear, so that it may be quickly brought to the top of the page.

The straight-filament lamp is inserted at *L*, where it is held by a spring clip, and whence it can easily be removed for renewal even by a blind operator. The balancer is inserted at *B*, and can be adjusted for silence by means of the small handle shown.

Fig. 3 shows the apparatus from the top page end and with telephone and flexible connections attached, as well as the book-rest *V* holding a book. The adapters of the flexible connections are all of different sizes and fit into different-sized holes in such a manner that they cannot be wrongly inserted.

The operator of the optophone reads by the tones and combinations of tones emitted by the telephone receiver. The numbers of perforations in the siren disk are in proportion to the notes G, C′, D′, E′, G′, (sol, do, re, me, sol) of the musical scale. The spot of light corresponding to low G falls on the lowest point of such letters as j, p, y, etc., the high G′ falling on the tops of capitals and high letters. The three intermediate spots cover the body of the lower case letters. With a "black-sounding" optophone the letter *V* is represented by the motif (high) sol, me, re, do, re, me, (high) sol.

In practice it is found that, with the new apparatus, the various adjustments for size of type, length of line, and line interval are quite easily made by blind persons, and that the instrument, with all its delicate adjustments, can remain in use for a long time without anything getting out of order. As for speed of reading, we are told that Miss Mary Maeson, the blind girl who has been giving demonstrations with the optophone for some time, now reads habitually at a speed of about 25 words a minute with a "white-sounding" optophone. But again we repeat, a so-called musical ear is a very necessary qualification.

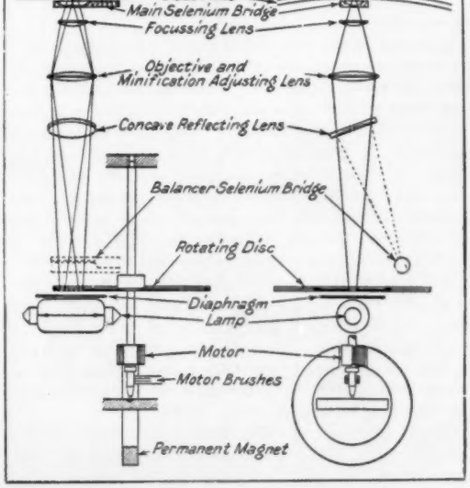

Diagram of the arrangement of the optophone as seen from two sides

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Our Surplus, Our Ships, and Europe's Need

THANKS to our enormous industrial development during and even since the war, thanks also and even more to weather conditions extremely favorable to agriculture, the United States finds itself with a great surplus of products on its hands. Also, because of our enormous shipbuilding activities during the war and since, we find ourselves possessed of the second greatest merchant fleet in the world, with probably 70 per cent of it consisting of absolutely new shipping and most of it made up of cargo-carrying vessels.

On the other hand, if we turn from the thought of our own superabundance and let our gaze rest upon Europe, we find there a scarcity so great that the peoples of the old world, or at least of the western half of it, are looking with hungry eyes upon our unused and unusable superabundance. At present market values we have surpluses, available for export, of $800,000,000 in cotton, $600,000,000 in wheat, $250,000,000 in packing-house products, $750,000,000 in semi-manufactured raw materials and finished manufactured products of various kinds—all this according to E. M. Hurley.

There is no lack of ships. Anyone who has had occasion to traverse any of the great harbors of the Atlantic seaboard must have wondered why in the world such quantities of cargo ships flying the American flag are floating high and empty on the mooring grounds of these harbors. It certainly does seem pathetic or monstrous or wasteful or ridiculous, according to the point of view of the speaker, that so much suffering, unrest and threat to the social and economic structure should be allowed to persist, when the means to relieve it in the way of surplus products and surplus ships are right at hand.

If that overworked "Visitor from Mars" were to ask the why and wherefore of these amazing conditions, he would be told, as Mr. Hurley recently told the diners at a banquet of the National Marine League, that "while the countries of Europe are in the market for the major portion of our surplus, our marketers of wheat, cotton and other products still ask for payment in gold at our seaports before goods are shipped." In answer to his inevitable question as to why they do not pay in gold, we should have to explain to him that most of it is already in this country.

To the student of economics the explanation is perfectly clear. These suffering countries cannot pay us in gold for they have it not. It is out of the question for them further to inflate their currency by creating huge indebtedness, for they are already overloaded. The problem is not one to be solved by the assistance of the United States Treasury, for already we have loaned over ten billion dollars to Europe. It is the belief of Mr. Hurley and of an increasing number of our leading business men that the problem should be solved strictly on a commercial basis. With these enormous excess products to sell and with our natural overseas customers restricted in their purchasing power, we should coöperate to place them in a position to make their needed purchases. It should be possible for the marketers of these divers products themselves to work out coöperatively a system of credits; and it is suggested that the creation of a commercial bond issue of from one hundred million to one hundred and fifty million dollars would furnish a sufficient fund during the period of the marketing of these products. What is needed and needed at once is a relatively limited creation of additional private credit without invasion of government credit.

As to the security, the marketers of the various products would receive in return an obligation from the purchaser, definite as to amount and interest and time of payment. These would constitute the security. They would have the guarantee of the purchaser's particular Government, which, Mr. Hurley assures us, nearly all of the European Governments are willing to grant. It is possible also that the guarantee of the marketers in this country would be added. We do not doubt that this relatively small bond issue secured in the manner suggested would be quickly absorbed here. The benefit to Europe would be immediate and incalculable.

Joys and Sorrows of the Einstein Editor

EVERYTHING has its lighter side. Even the Einstein Editor, on whom devolves the function of opening and recording the essays received in the contest and preparing the tentative abstracts of them for the use of the judges, reports that his cloud has a silver lining. We consider this the height of optimism; for at the hour of going to press there are 151 essays in, with five days still to run.

However, the unfortunate member of the staff most directly involved assures us that the bright spots are there. For one thing, he regrets the day when he rashly required the contestants to send their inner envelopes sealed. In Europe this means legally sealed and stamped with a splash of wax—or several splashes. It is, on this side, rather a novel experience to receive a bulky envelope bearing five ponderous red or black smears—one at the crossing of the flap in the middle and one off toward each corner; and on opening this, to discover in it two smaller envelopes, each similarly decked out. There has been enough wax used in this contest to float a dreadnought.

Another amusing item is the envelopes. Purely on the basis of mathematics, if 151 gentlemen are to select two small envelopes and a larger one to hold them, it would seem that some two of these 453 containers would necessarily be of the same size and shape. The Einstein Editor finds that performance gives the lie to theory; and he contemplates a dissertation in which the foundations of the theory of probability will be revised. It is impossible that the world contains so many different styles of envelope—impossible, but true.

A curious feature is that several contestants have selected subjects of their own—"Mastering Success," "Leagues of Nations in History," "The Situation of a Government Clerk in the Madras Presidency, India," etc. We are puzzled to know whether local papers have announced the contest without troubling to announce that the subject was prescribed; or whether these worthies have tried to display a Machiavellian cunning in writing on a subject of which the judges shall not be wearied.

Discounting the few trivial essays inevitable in such a contest, the general level of competition is gratifyingly high. It is interesting to note that German and French and Dutch authors show on the whole rather good command of the English language. One German essay, in particular, on being examined by our two editors who display greatest literary talent, provoked the admission that, with the same ideas to express, neither of these gentlemen would dare hope to clothe them in more elegant or more precise English. By way of contrast, there comes another effort which bears indisputable evidence of having been written first in German, and then, with the aid of a dictionary and a colossal ignorance of the English language, lifted over, word by word, into English. The author confides that he hopes to win the prize, but that failing this he has at least "learned some English." Just how much, appears from the following excerpts:

"Some 400 jears ago the earth was a side-ways unboundet mass, above the heaven and under the hell. By degrees but heavy one accustomed thereon, that under us also men live and thereto with the feet to above and they stand however fast on the earthground, when they with the finger to above show, so is that the same direction, as we under name. . . . So will go also a time, that all thereon accustom, that after Einstein we not a absolute and only a relative time have. . . . Think we us the world-room like a absolute reposing empty reservoir. . . . Einstein remove this hardiness. . . . Think we us a planet go tight to the earth over, our clocks have equal going time. . . . When now the time-measurings of two world-bodys are differently and therefore a world-body not can direct his clocks after they of the other world-bodys, but we should be able, the inhabitants of the planet to convince from the contemporary existence of our clocks in two differently points on the earth. . . . But uniform moving curvations are not on the pathway of the world-bodys in the whole world-room according of the gravitation or far-effect, where by the objects move with changed hasting swiftness in crooked curve-lineal pathway. . . . The lines of a system run liking so by each others, that they opposite not cut through and all the points of the world-room befal."

Some knowledge of German is of course necessary to a full appreciation of this gem. Those lacking such knowledge will get a clue to the author's general style by comparing his first two sentences above with our editorial of Dec. 20 last, "The Nature of Things," in which the Einstein Editor set forth the same general ideas. Are we to assume that this is even his source? If so, we are flattered indeed!

The Stability of Ships

IT would be instructive to know what proportion of ships that founder do so because they have insufficient stability. Everyone that takes an interest in matters pertaining to the sea must have noticed how frequently the efforts to save an injured ship are cut short by her capsizing. Many people must have noticed, during the war, that a majority of the warships that were heavily punished by the torpedo or by gun fire turned turtle before they sank, and the history of the merchant marine teaches the same lesson. It is not sufficient merely to protect the flotation of a ship; her stability also must be assured.

Naturally, the matter of stability becomes of more importance and requires greater watchfulness in proportion as the vessel is in a light condition and standing high out of the water. The naval designer makes careful calculations, and before the ship passes out of his hands, determines what ballast she should take aboard to compensate for the absence of cargo, and these data are furnished with the ship. Naturally, because of the great diversity in the model of ships and in the service to which they are put, the margin of stability will vary greatly also, and in some vessels it is necessary to exercise particular watchfulness.

A striking example of this is found in the capsizing last June of the U. S. Navy Eagle Boat "Number 25" during a violent squall in the Delaware River. From the findings of the Naval Court of Inquiry, we learn that this boat, being in an unusually light condition of load, had such a comparatively small range of stability as to make her an unsafe sea boat; that this condition was due mainly to the absence of her allowance of ammunition and to the fact that she had exhausted her supplies of fuel oil, water and stores. There was no stability data regarding the operation of the vessel on board the ship.

Rear Admiral Taylor, whose Bureau was responsible for the design of the ships, shows that responsibility for the disaster was not to be laid at the door of the Bureau of Construction and Repair. He tells us that when the first Eagles were completed and after an investigation of their stability, his Bureau issued a memorandum calling attention to the desirability of taking water ballast aboard when at sea in light condition. The data was furnished to the Eagle vessels then in commission, and instructions were issued to the superintending constructor at the building yard to see that every vessel, when completed, had a copy of the stability data. This order was not carried out.

Any repetition of such a disaster is to be prevented by placing fixed ballast aboard all Eagle boats, and this will give them such stability that there need be no concern about water ballast in any probable seagoing condition.

Electricity

A Blazing Fire with Electricity instead of coal is the latest electrical development in England. It is known as the electric fire and can be fitted into any existing grate. This electric fire has the same blazing appearance at any adjustment, ranging from 200 watts to three kilowatts consumption. There being no combustion, no flues or chimneys are necessary and the fire is particularly essential in ships. Both the "Olympic" and the "Aquitania" are fitted with these fires.

Convertible Caps.—The electrical industry has a tendency toward standardization of fittings and accessories, just as in any other progressive industry. Just now there is a move on foot to make all caps for attachment plugs and wall receptacles convertible so that the blades can be made to fit any arrangement of slots. There are parallel slots, tandem or in-line slots, angle or T slots, and double T slots; but the new convertible caps can be adjusted for any arrangement of slots.

Radio Compass for Directing Airplanes to Ship.—Guided entirely by radio compass signals, a Naval seaplane "F-5-L" left Norfolk and flew 95 miles on a straight line to pick up the battleship "Ohio" at sea, with no knowledge at the time of taking the air of the vessel's location, according to *Wireless Age*. The seaplane then navigated its return to Norfolk entirely by radio compass. Navy Department officials to whom the flight was reported said it was the first time radio compass apparatus had been used to direct aircraft to a ship.

Pictures via Radio.—"Very interesting and very important" is the way Marconi recently expressed himself regarding the transmission of photographs by radio. It appears that several systems of this kind are being worked out at present, one of which known as the Belin system is described elsewhere in this issue. "I have not followed the experiments, but I know it can be done," continued Marconi. "Pictures were sent over telegraph wires several years ago, and what can be done by wire can be done by wireless. It will be of great interest to watch the progress made. The two chief uses to which the discovery can be put are the quick transmission of photographs for newspaper and police purposes."

Radio Telephones for the Foresters.—The British Columbia forestry branch has recently closed a contract with the Marconi Wireless Company of Canada for the installation of four land stations and five launch equipments, for use in forestry and fire-protection work. One station, at the forestry office in the courthouse, Vancouver, is already installed, and the first installation on one of the small gasoline boats has been placed. Successful tests have been carried out between these two stations at distances varying up to 75 miles. On account of the rugged character of the coast country this distance is the limit of the radius to be attempted for the present, although the extreme radius of the wireless telephone is stated to be 300 miles over flat land or over water.

Telephoning Over High Voltage Lines.—An American concern has recently developed an unusual system of telephony which can be used for communication over the usual high-tension lines. Thus there is provided a reliable and safe telephone system which best solves the power companies' communication problem and can be obtained with a telephone line mounted on the same poles as the transmission lines, without transformers or drainage coils; telephone sets in all stations which are safe to operate during serious line troubles; portable apparatus easily carried by any patrolman or line gang, which can safely be connected to the telephone line at any point. Any station can call other stations. Patrolmen or line gangs can call into a station from any point along the line. A station can call any patrolman or line gang near the telephone line. The apparatus, which is obviously different from existing telephones, may be described in a future issue.

Recent Tendencies in Cable Manufacture.—From a recent issue of the London *Electrician* we learn that the British have led in the development of satisfactory cables for underground transmission, for the reason that underground transmission is so commonly adopted in England. It is said that impregnated paper has proved its value by being used to an enormous extent for all pressures and conditions, and that it is the only really reliable and satisfactory dielectric for extra high pressures. The only serious competitor is vulcanized bitumen, which has lately emerged into an article of general manufacture and use. Its rise is mainly due to the extension of electricity in the mining industry. Being neutral to the peculiar moist conditions in mines, independent of a heavy sheath, semi-flexible, and not requiring the skilled care of a hydroscopic dielectric, it has found acceptance among colliery managers. It is also held that the steady rise in working pressures from 3,000 volts to 30,000 volts has not produced any drastic change in cable materials.

Astronomy

The Need of Comet Observers.—Dr. A. C. D. Crommelin has recently called attention to the small number of unexpected comets that have been observed in recent years. For example, in 1919 four of the five comets picked up during the year were returns of periodic comets previously known. Dr. Crommelin thinks that the scarcity of new comets simply means that few observers are hunting for them, and points out that there is an opening in this field for energetic amateurs.

New Solar Observatory of the Smithsonian.—The Astrophysical Observatory of the Smithsonian Institution has established a new station for the measurement of solar radiation on the Haqua Hala Mountains, near Wenden, Arizona, where the atmospheric conditions are said to be exceptionally favorable for such work. The observations at the new station, in conjunction with those made at the Smithsonian station at Calama, Chile, are expected to furnish interesting information concerning fluctuations in the solar "constant."

The New Bulletin Astronomique.—Since 1884 the Observatory of Paris has published a journal known as the *Bulletin Astronomique*, containing astronomical memoirs, observations, notes, and abstracts of current literature. This journal has now been divided into two distinct publications, one of which will be devoted entirely to abstracting. It is planned to publish the abstracting journal monthly as soon as the printing situation permits, but it has been begun as an annual, the first number covering the year 1919. The companion publication, bearing subtitle *Mémoires et Variétés*, will appear at irregular intervals.

Lunar Photography with the Hooker Telescope.—A few lunar photographs taken with the new Hooker 100-inch reflector of the Mount Wilson observatory have been so widely reproduced in magazines, in newspapers that some information concerning the circumstances under which they were made and the relation they bear to the general program of work at Mount Wilson will doubtless interest many readers. The pictures thus far published were obtained in the course of a wide variety of tests to which the new telescope has been subjected. They have been enlarged from negatives made at the Cassegrain focus of the telescope, where the equivalent focal length is 134 feet, corresponding to a diameter of the lunar image of about 11 inches. The exposures were about one-half second, reduced to a smaller fraction toward the much brighter limb by the exposing shutter moved before the plate. According to a statement by Director Hale, from which we gather these facts, there is no present intention of doing much work in lunar photography with the Hooker telescope, on account of the heavy demands of the regular program of research. This policy may, however, be modified in view of the recent action of the National Research Council in appointing a committee of geologists to examine the lunar photographs made at Mount Wilson and elsewhere and report what scientific results might be expected from a study of such documents, from the point of view of the expert in volcanology, topography, etc. Dr. Hale points out that few astronomers are qualified to study the moon's surface as a geological problem.

More Views on Signaling to Mars.—At the last annual meeting of the Kentucky Academy of Science, Prof. Henry Meier of Centre College set forth certain factors of the problem of signaling to Mars. In the first place, he said, the probably low temperature and rare atmosphere and the absence of water vapor (not, we would remark, universally admitted) are against the existence on the planet of beings endowed similarly to ourselves. Ability to signal by light is negatived by the fact that the earth's atmosphere would absorb about 40 per cent of the light sent out, and by the great distance. The author estimates that an area of light 10 miles square on earth, seen from Mars through a telescope magnifying 500 times, would appear like an area 1 inch square, viewed at a distance of 500 feet. The possibility of signaling by radio is negatived by the distance, it being computed that it would require a current of a million amperes at the sending station to obtain one of one ampere at a receiving station on Mars, when the planet is nearest the earth. Besides, the powerful currents radiated from the sun would probably overwhelm the weak waves sent out from the earth. While these objections are valid as far as they go, we would suggest that the real crux of the problem is the extreme improbability that a race of beings sufficiently "human" to hold any sort of intercourse with us exists on another planet. Once assume their existence, and it is easy to conceive them so far advanced in scientific attainments as to be in nowise dependent upon "a telescope magnifying 500 times" to catch our signals.

Aeronautics

An Aerial Survey of United States.—Steps are being taken with regard to the making of a geological survey of this country by the aid of airplanes. The participation of New York State in the survey will necessitate about ten stations being established, or one for every 8,000 square miles. The estimated cost of producing the necessary photographic maps has been figured at anything from $5 to $10 per square mile.

Increasing Popularity of London-Paris Route.—The last figures which have come to hand with regard to the London-Paris air service indicate the steadily increasing popularity of that route. During July 933 persons so traveled, making a daily average of 30 passengers. The continuous increase in traffic is brought out by comparison with the number of passengers carried in February, 102; March, 183; April, 198; May, 450; June, 775.

Sweden's Air Mail.—We learn from our English contemporary *Flight* that an application has been made by the Swedish postal authorities to the Government for permission to establish a regular aerial mail route between Malmoe and Berlin, via Warnemuende. It is proposed that the service be maintained by German pilots on Junker machines, and it is stated that the consent of the Allies to this has been granted for a period of three months.

New York to Alaska and Return.—When the four airplanes of the U. S. Army Air Service Alaskan Flying Expedition touched ground at Mitchel Field, Long Island, on October 20th, the feat marked the completion of a flight over some 9,000 miles of uncharted territory in the last three months. The machines returned as spick and span as on the day of departure, July 15th. The machines were "DH-4-B" biplanes, made by the Gallaudet Aircraft Corporation of East Greenwich, R. I. Each plane was powered with a 400-horse-power Liberty motor.

A Word About Baby Airplanes.—From time to time a photograph appears, depicting a new airplane of compact dimensions and equipped with a low-power engine. Such airplanes are generally hailed as "everybody's" airplane and the coming "flivvers" of the air. Yet an examination of these machines soon discloses the fact that they are of little practical value. They are too small to be steady in flight, too low-powered to fly under moderately adverse conditions, too flimsy to last long, and, taking it all in all, absolutely worthless for serious work of any kind. They should generally be treated as novelties, except in rare instances.

The World Flight.—Aeronautic authorities have been busily engaged in formulating a fair set of rules governing the coming 'round the world flight. That aviators will not be permitted to take advantage of the rotundity of the earth is indicated by the condition that they must make their flights between the 15th and 60th parallels of latitude, and the prize will go to the flier who covers the longest distance. Aviators will be allowed to start from any point they choose, providing they return to the starting point. They will have a year in which to complete their flight. Airplanes, dirigibles, and free balloons are eligible for the race.

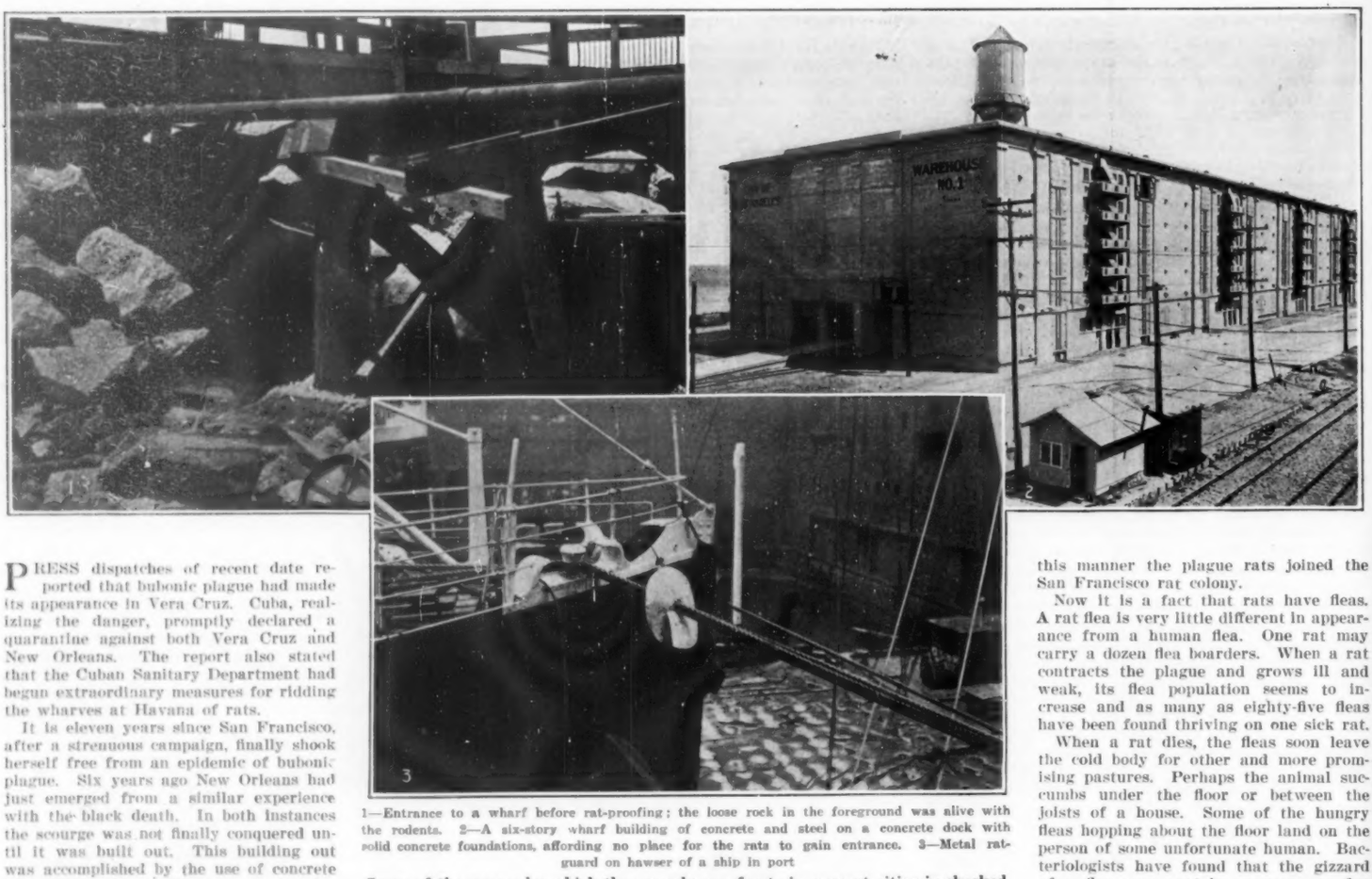
More Accuracy, Please!—If there is one thing which may be said against present-day aviation, it is that figures are handled in a loose way by those in and out of the art. Thus a new machine is said to make 225 miles per hour during a test flight, and yet the same machine, when flown over a definite course and with the proper officials at hand, fails to make anything like 200 miles per hour. There has been altogether too much loose talk about speed, climbing rate, carrying capacity, and so on, followed by such keen disappointment in actual performance that the art has suffered much criticism in consequence. Loose facts and figures and boasts do not win victories or make new records. Performance counts. It is time for all of us to stick more to cold facts and figures—and feats.

Airway Upkeep.—In the course of a statement in the French Chamber recently the Assistant Secretary of Aviation stated that the cost of upkeep of airdromes, hangars, repair shops, meteorological and wireless stations on the French portion of the Paris-London service was estimated at 20,000 francs per kilometer as against the cost of 50,000 francs per kilometer for a single line of railway. He thought that in future the total cost of organizing an aerial service would be 10,000 francs per kilometer. On the other hand, he emphasized the difficulties due to present heavy charges on flying plant, the French calculation of the life of an airplane being 200 flying hours, which meant that about 3.50 francs per kilometer had to be added to the total cost of the service. This, however, he had hopes of seeing reduced.

Building Out the Bubonic Plague

How the Twentieth Century Controls the Scourge of the Fourteenth by Waging War on Rats

By H. G. Adams



1—Entrance to a wharf before rat-proofing; the loose rock in the foreground was alive with the rodents. 2—A six-story wharf building of concrete and steel on a concrete dock with solid concrete foundations, affording no place for the rats to gain entrance. 3—Metal rat-guard on hawser of a ship in port

Some of the means by which the prevalence of rats in seaport cities is checked in the war on bubonic plague

PRESS dispatches of recent date reported that bubonic plague had made its appearance in Vera Cruz, Cuba, realizing the danger, promptly declared a quarantine against both Vera Cruz and New Orleans. The report also stated that the Cuban Sanitary Department had begun extraordinary measures for ridding the wharves at Havana of rats.

It is eleven years since San Francisco, after a strenuous campaign, finally shook herself free from an epidemic of bubonic plague. Six years ago New Orleans had just emerged from a similar experience with the black death. In both instances the scourge was not finally conquered until it was built out. This building out was accomplished by the use of concrete and metal in replacing old wooden wharves, sidewalks, basement floors and other harboring places of the rat.

The Citizens Health Committee of San Francisco, after completing its labors in connection with the epidemic, issued an extensive report of experience in fighting rats and stamping out the plague. Exceedingly interesting is the information contained in this statement: helpful facts that will be useful to other communities that find it necessary to make an organized effort against the same menace.

Among the activities of the Citizens Committee we find that 4,291,000 square feet of basements and floors were concreted; 1,190,000 square feet of concrete were laid in stables; 11,342 houses were disinfected and 1,713 destroyed; 3,967 stables were concreted, 903 ratproofed otherwise and 373 vacated; 5,000 chicken yards were ratproofed and 11,000 voluntarily vacated; and 676,000 square feet of chicken yards were graveled or concreted. The financial statement of the committee in itemizing some of the costs of this campaign, discloses some illuminating figures. It shows an expenditure of $4,012.42 for rat bait, which included 12,930 pounds of cheese, 5,042 pounds of bacon and 8,810 pounds of rat paste. Another item was for $1,438 to cover the cost of 14,608 rat traps. Bounties for catching rats at ten cents each amounted to $12,375.

During the first six weeks of the fight against the pestilence 56,994 rats were trapped or found dead. Thousands of others were washed out into the bay as a result of poisoned bait placed in the sewers. One week's rat catch amounted to 7,307. Of this number 2,382 were examined bacteriologically and 12 found to be infected with the plague.

The first visitation of the plague broke out in San Francisco in 1900 and it appeared again in 1907. The two epidemics claimed a total of 190 human lives before the malady was finally stamped out.

Just here it might be well to describe for the benefit of those who are not informed, how the bubonic plague is communicated to the human family. A vessel hailing from an Asiatic port tied up at a wharf on Frisco's water front. In the ship's hold lurked some bubonic-infected rats. Some of these little scourge-bearing messengers left the ship by creeping out along the huge rope hawsers that bound the vessel to the dock. In this manner the plague rats joined the San Francisco rat colony.

Now it is a fact that rats have fleas. A rat flea is very little different in appearance from a human flea. One rat may carry a dozen flea boarders. When a rat contracts the plague and grows ill and weak, its flea population seems to increase and as many as eighty-five fleas have been found thriving on one sick rat.

When a rat dies, the fleas soon leave the cold body for other and more promising pastures. Perhaps the animal succumbs under the floor or between the joists of a house. Some of the hungry fleas hopping about the floor land on the person of some unfortunate human. Bacteriologists have found that the gizzard of a flea may contain as many as five thousand bacilli of the bubonic plague. The flea can carry these about without any apparent ill effects upon its own health.

It is through the bite of the flea that the plague is transmitted from rat to rat and from rat to man. It was found during the epidemic at San Francisco that the plague attacked people who were in good health and living in sanitary, cleanly surroundings. One of the victims was the wife of a physician.

Fleas taken from a rat that had died of the plague were allowed to bite a guinea pig with the result that the animal at once became infected with the disease and died.

In San Francisco at this time, a man was found dead with the plague. The health officers ripped up the floor of the cottage in which he had been living and found a veritable honeycomb of rat holes. They also found several dead rats and the bacteriologists discovered upon examination that the rats had died of the disease. So the rat, tried and convicted, was sentenced to go.

One of the first steps in the program was to keep all garbage containers tightly covered. Measures were also taken to prevent food scraps from being scattered about. Where grain and meal stuffs were carried into buildings over gangways canvas was suspended beneath the trucks to catch the siftings, so that no rat food should be left on the ground. As an illustration of the importance of these small details, the last two bubonic rats caught in San Francisco were taken in a warehouse where they had been attracted by some fruit and nut culls left carelessly about. The rats had evidently entered by

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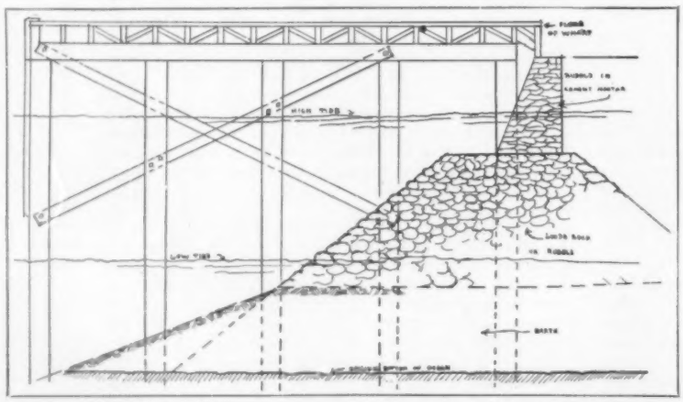


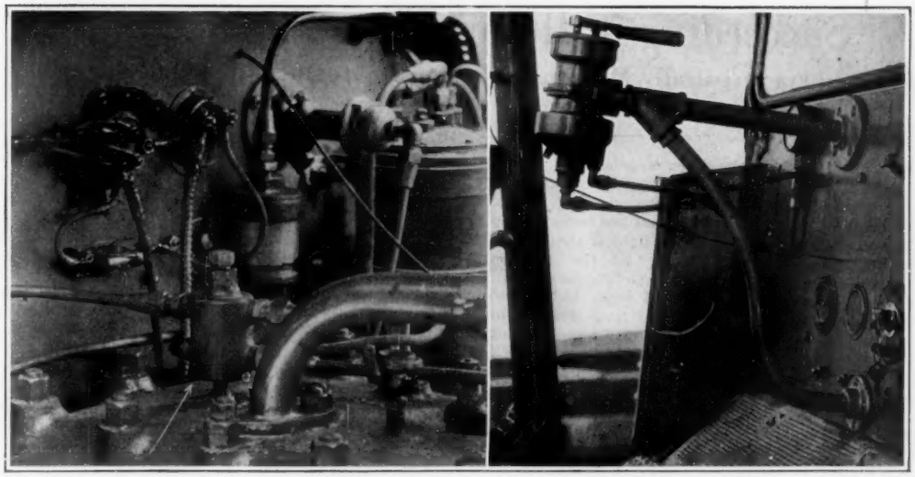
The loose rubble and the solid concrete wall meet at a point just below high tide. Any rats finding a temporary hiding place in the crevices of the loose rock are short-lived

The details of rat-proof wharf construction

Airbrakes for the Automobile

By C. W. Geiger

UNUSUALLY severe tests of automobile and truck brakes were made at the Safety First Exposition held in conjunction with the National Traffic Officers' Convention at San Francisco. The accompanying photographs show a system of air brakes for automobiles and trucks and trailers which proved to be nearly five times as efficient as the ordinary brakes. A five-ton truck and a five-ton trailer traveling at 18 miles an hour was stopped within 11 feet by means of the air brakes, the distance required to stop a truck and trailer equipped with the ordinary brake being 50 feet.



Left: The manner in which the accumulator valve, indicated by white arrow, leads off from one of the cylinders via the pet-cock opening. *Right:* The dash-board assembly from which the driver operates the new brake

Two views of the air-brake outfit for motor-truck use

This air brake system is of remarkable simplicity. It may be adapted to motor cars, trucks, trailers, semi-trailers and small industrial railways. It is flexible and may be used for operating the truck brakes only, or one or more trailers may be attached at any time and four-wheel brakes can be operated on trucks or trailers with a minimum of equipment.

Air pressure is obtained from one cylinder of the engine and is automatically maintained by means of an accumulator valve with only one moving part. Only a very small quantity of air (or spent gas) is taken at each stroke of the motor and only excess pressure can pass through the accumulator. When the engine is idling a pressure of 25 to 50 pounds per square inch is maintained in the tank but a laboring motor will raise the tank pressure to 200 pounds. The accumulator automatically stops when the tank pressure balances the pressure in the engine cylinder.

The control valve operates on an entirely new principle and is designed especially for the close regulation of brake pressure necessitated by the wide variation in loads, grades and road conditions. The brakes are applied by pulling the brake-valve lever toward the driver, the greater the movement the higher the brake pressure. To release the pressure move the lever back an amount corresponding to the effect desired. Quick return of the lever to full-release position exhausts the brake pressure through a quick-release valve which has only one moving part.

In order to insure instantaneous and complete response to the slightest variation in the brake-pipe pressure the brakes are actuated by a heavy rubber diaphragm in a bronze case. There is no leakage through a diaphragm and no friction is generated to resist movement at the least variation of pressure. No piston packing and no lubrication is required. The diaphragms are designed to apply more brake pressure with only 20 pounds of air than can be generated by the ordinary bandbrakes.

The system can be installed on any truck or trailer without any changes in the usual equipment and without affecting the operation of the ordinary brakes. The diaphragms may be mounted on each wheel or one for each pair of wheels, according to the type of truck. The system operates uniformly with full load, no load or even with broken springs.

The air-braking system is controlled by the driver with a small hand-lever, which is located just below the steering wheel on the support that carries the spark and throttle control. Directly in front of the driver is a gage which indicates the pounds per square inch pressure in the air tank, carried under the truck chassis alongside the frame, and also the amount of pressure per square inch used at each braking operation.

A line of air hose extends from the air tank to the brakes on the rear wheels of the truck and is then connected through regular air hose on the trailer. The action can be made to operate on the truck and trailer at the same time, or if the trailer is not used a valve on the rear end of the truck chassis is adjusted to control the air for braking on the truck alone. In the case of two or more trailers being used, the air arrangement is coupled progressively to the second and third, etc., and handled in just the same way. However, when more than two trailers are operated a specially designed air compresser is installed running off the drive shaft.

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Automobile Signals for Danger Spots

By G. H. Dacy

DURING a nine months' period last year, according to official reports of the Interstate Commerce Commission, there occurred 1,836 automobile accidents at highway grade crossings which resulted in the death of 923 persons while 2,554 people were badly injured. The grade crossing, the abrupt descent and the difficult and hazardous curve are the principal topographical and constructional hazards which jeopardize the lives and limbs of motorists in all sections of the country. Many danger signals and warning signs have been promoted and tried out but—for the most part—they do not efficiently serve the purpose for which they are designed.

Recently several ingenious signals of a new construction and type have been presented. The device of Charles E. Lyman, Asheville, N. C., appears particularly efficient and satisfactory. Briefly this signal consists of treads which are laid in the roadway in such a manner that as the automobile passes over them it presses down on a spring connection which completes an electrical circuit and lights a red lamp, rings a bell or sounds a horn in the roadway some distance ahead of the approachng motorist to warn him of a dangerous curve or crossing on the road ahead.

The operating part of the signal consists of two steel treads six feet long, three inches wide and 1¼ inches thick. They are hung on shaft ends at one edge and are braced underneath by five steel cross supports. The free edge of each tread is raised about ¾ of an inch by two 1¼-inch spiral springs placed underneath. The weight of the outfit is 600 pounds. At one end of the treads a double switch-box is installed, the outer of the two switch-boxes being part of the frame, while the inner is detachable and removable. The treads are separated by a parting strip.

The switch box contains two small shafts which engage at their inner ends by a coupling or tongue and groove arrangement with the shaft ends of the treads so that when the switch box is in position the depression of either tread operates the corresponding small shaft in the switch box. The main operating tread is at the right, the black saddle being used in order to give a better bearing surface for the wheels of the cars which pass over it. The left-hand tread is the silencer tread. Its function, when struck by a car going away from the danger point, is to throw the

(*Continued on page 480*)

Left: A suggestion in parking; it is as easy to back out as to run out forward, while it is much easier to go in forward than backward. *Right:* A new tread road-signal, with the operating tread at the right, and the disconnecting tread for cars coming in the safe direction at the left

Two new illustrations of old ideas for street comfort and road safety

Succeeding in Illuminating Engineering

What This Characteristically Modern Profession Holds Out to the Man Who Enters It

By Raymond Francis Yates

ILLUMINATION has an interesting history of development. It is only during the past few years that it has crystallized into a definite engineering science. It is no longer carried out by rule-of-thumb methods. The illuminating engineer has come into his own. He is today master of a science that is in its infancy. Many of the problems he has to contend with should have been solved years ago, but it is only recently that illumination has come to be regarded as the serious thing it really is.

It almost sounds unnecessary to say that this phase of engineering offers an attractive field for the young man. Any field of human endeavor that has just started to develop offers opportunity of the richest variety. Illuminating engineering is such a field.

Yesterday the lighting problem of a building was a matter of expediency. Today it is a matter of science. There is a scientific reason for doing things this way or that way in planning the lighting of a building. Illumination has always been just as important as it is today but it was just one of those things that no one recognized.

In preparing this series of articles the writer has always tried to obtain the ideas of a man of high standing in each field. The logical choice in the field of illuminating engineering was Mr. E. S. Doane, Chief of the Nela Research Laboratories at Cleveland, Ohio, and President of the Illuminating Society. Mr. Doane has reached the very highest plane of his profession and many of our lighting problems of today have been solved by his painstaking efforts and through his careful direction of the many experts who work under him. It is with a feeling of confidence that the writer gives Mr. Doane's ideas in the following paragraphs.

What is an illuminating engineer? One who studies lighting, of course, you say. Quite true, but many will be surprised to know that illuminating engineering is not recognized by our colleges at the present time. It is not because the field lacks the dignity of an established engineering science. It is because it is so young. In this respect it might be compared to radio engineering.

An illuminating engineer may be educated as a gas engineer or an electrical engineer. It is through special study that a man becomes capable of contending with the various problems of lighting as applied to streets, buildings, etc. This does not mean that any man without an engineering education cannot learn to apply the principles of illumination and become an illuminating engineer. If he desires to do this, he must first train himself in the fundamentals of either gas or electrical engineering. A sound knowledge of electrical engineering is the foundation of the application of illuminating engineering.

Mr. Doane describes an illuminating engineer and his work in these terms:

"I feel that illuminating engineering knowledge should be a part of the equipment of many different classes of engineers. Illumination is often referred to in two different senses: non-specific or general and specific.

"The man who designs general illumination, in which is included the lighting of public places, building interiors, etc., is usually primarily a gas engineer or electrical engineer, and usually also belongs to a subdivision of the general group. For illustration, he may be the engineer of electrical or gas distribution. I think in all such cases such a man becomes an illuminating engineer after having been trained as an electrical or gas engineer.

"The man who uses light specifically whether he be the engineer on a construction job, a mechanical engineer who builds his lighting apparatus in as a part of his design, whether he be an architect or whatever be his basic training, must many times in his career have charge of work, in which his knowledge of illuminating engineering would be of much value."

A curious public is just starting to be interested in the quantity and quality of light needed in various cases. The necessity of selecting the proper reflector, refractor and projector and placing in this light distributor the proper kind of lamp, is just starting to be recognized. Mr. Doane say that: "We are only just now approaching the time when work will be done under light chosen specifically for the particular kind of work on hand. I know of no other field of engineering that has been so long neglected. The usual factory is so lighted that work is not produced at maximum rate or of the best quality. We have demonstrated again and again that production and quality are improved under lighting which is technically correct. I know of no better way in which an operative can better his output in quality and quantity without added effort to himself and without new machinery," etc.

It would be difficult to find words that would impress one more with the great importance of illumination. It is a young field with a golden future. We are only starting to systematize our knowledge along this line. The work to be done is vast in bulk and important in nature. It will not only have to do with the conservation of human energy and the increasing of human efficiency, but also with the preservation of human eyesight, which is the most serious question of all. The lighting of the past has been a treacherous wrecker of eyesight.

When asked how a young man should educate himself to become an illuminating engineer, Mr. Doane expressed himself as follows: "The education one gets in college should be primarily to specializing in illuminating engineering. A real illuminating engineer must of necessity have other engineering knowledge. This should naturally be acquired before his illuminating engineering education. After that I know of no better way for a man to become informed as to his needs or to obtain the finishing touches of his education than through membership in the Illuminating Engineering Society. I believe that the same general qualifications required for civil, mechanical or electrical engineering are necessary to become an illuminating engineer although a man should have a greater knowledge of physics, especially as regards the physics of light."

THE great electrical works at Schenectady has a large department within its technical organization devoted exclusively to solving the problems of electric illumination and making new discoveries in this vital field. A glance at the advertising pages of any prominent publication of wide appeal will disclose many large concerns that deal in nothing but lighting equipment and handle none but lighting problems. The business of making night compete with day and indoors with outdoors is a characteristic of our modern civilization, and a very important one; it furnishes a field in which epoch-making discoveries have been and will be made. To the young man in search of a profession there can hardly be a domain that promises more in the way alike of achievement and of return; and in his present article Mr. Yates tries to show just what pursuit of this promise is likely to yield.—THE EDITOR.

When Mr. Doane was asked how far he thought an illuminating engineer should go in mathematics he became deeply interested. He maintained that mathematics is nothing but the shorthand of numerical reasoning. He looks upon it as a process which enables one to reason with exactness. We have learned that one cannot reason exactly and use values, without recording the progress of his reasoning from step to step.

How does salary run in illuminating engineering? For those who regard the answering of this question as being necessary it can be said that the salaries are about the same as those of electrical engineers. Experts in this line are able to demand high salaries, while from $3,000 to $5,000 is the usual salary for a man of ordinary standing in the field. The young man must always keep in mind that salary is always a measure of ability and not a denotement of profession.

Now comes the question of college. Can a man become a successful illuminating engineer without attending college? He surely can. The obstacles in this profession are no greater than in any other profession. It all depends upon the man. It would be advisable for a man with ambitions along this line to locate himself as an assistant in some of the big illumination laboratories.

Can an illuminating engineer go into business for himself? In one way he can. He can establish himself in the electric wiring business and in this way use and advertise his knowledge of illuminating engineering. Indeed it is regrettable that more of our so-called electricians are not capable of giving sound scientific advice on illuminating problems. Most of them are barely capable of intelligently using the new devices with which illuminating engineers have provided them.

Mr. Doane informed the writer that colleges are just beginning to show considerable interest in teaching the science of illumination. Through the efforts of the Educational Committee of the Illuminating Engineering Society, which is composed of professional educators, much progress is being made in raising the college course to a higher standing. Within a few years probably, our colleges will establish carefully developed courses in this new phase of engineering. The trouble is that so many new professions have developed within the past few years that our educational institutions have not had the time to develop courses.

What is the demand for illuminating engineers, is a question that the young man interested in this work is quite likely to ask. It is very easily answered. The demand far exceeds the supply, and any man thoroughly trained in this line of endeavor will find no trouble in locating with some well established organization.

This field does not seem to have reached the point as yet where specialists in any one of its particular branches are in great need. This does not mean that a man specializing in any of its branches will not find an opportunity to use his knowledge, whether he has specialized in street lighting or factory lighting. At the present time, and with manufacturers beginning to realize the importance of illumination as they are, it would seem that men specially trained to cope with the problem of factory illumination would find a fertile field to work in, with correspondingly good salaries. It is also true that a man specializing in the illumination of public thoroughfares would find good employment at a healthy salary if he is truly an expert. Municipalities are recognizing the lighting problem more than ever before and this country is annually spending hundreds of millions of dollars to light the streets of its cities. The author could name a dozen towns where one can stand in the center of the street at night and read a newspaper with ease, so perfect is the illumination.

As a final word. The young man who feels that this is an attractive field and that it satisfies his ambitions should not hesitate to dive into it. He cannot help but succeed. He can feel that he is growing up with one of the newest and most important engineering professions.

An Embargo on Fossils

AMERICAN savants, who have been excavating prehistoric remains from the wonderful valley of the Red Deer River in Alberta, Canada, which is held to be the Grand Canyon of Canada, may not be privileged much longer to take away these remains without let or hindrance. A very active campaign is under way in Alberta to have measures taken to place the removal of the fossils under restrictions to the end that the best of the remaining specimens may be kept for Canada.

For the last twenty years scientists from the United States have been digging out the fossilized skeletons of the monsters of the bygone ages. They have not been interfered with in any way and have had the full privilege of shipping out such specimens as appealed to them. Hence in New York, Washington and other places are to be found amazing skeletons built up from the fossilized bones gathered in this province.

On the other hand, the Dominion of Canada has no such specimens and the complaint is made that the youth of this country are debarred from seeing the rebuilt animals that once roamed the prairies. The defense of the government officials, who have not previously imposed any barriers to the export of the specimens, is that there are enough prehistoric remains, in the shape of fossilized skeletons, in the Red Deer Valley, to supply the museums of the whole world and leave countless numbers over.

Do Fish Swim as Airplanes Fly?

Striking Analogies Between the Laws Governing These Widely Divergent Styles of Moving

By M. Tevis

INVESTIGATORS have often attempted to find some parallel in the animal world to the motions made by the propellers of vessels and aircraft. So far as we know, however, there is no case exactly parallel, i.e., no active rotation of a portion of the body comparable to that of a propeller in any animal outside the protozoa. An analogous motion, however, to that of the propeller is that of a fish in water, as has been recently demonstrated by a German professor, Dr. Richard Hesse of Bonn. Just as the motion of an airplane or a dirigible depends upon the creation of air resistance, the swimming of a fish depends upon the creation of water resistance. The laws governing the motion of bodies in water and in air are of like nature. In both cases the moving body receives a buoyant impulse, i.e., it loses as much weight as is equal to the weight of the mass of water or air which is replaced; but since water weighs 760 times as much as air it is, of course, 760 times as buoyant. In each of them the resistance which a moving surface encounters increases in the same proportion as the area of the surface; but it increases according to the square of the velocity with which the surface moves.

Since the particles of air are so much more readily pushed out of place than those of water, much greater velocity is required in the air to produce sufficient resistance to support a given load. On the other hand the air offers correspondingly less resistance to the forward motion of the moving body and thus permits the attainment of much higher velocities. An interesting illustration of this fact is suggested by Dr. Hesse. Even such a powerful swimmer as the salmon moves on an average only at the rate of 0.8 meter per second, whereas a bee travels 7 meters in the same length of time, a pigeon 19 meters and an airplane as much as 39 meters.

A bird flies by means of a series of rhythmically repeated impulses at an irregular rate of speed. The motion of a fish, on the other hand, approximates that of a screw revolving in water or in air. By means of the revolution of the propeller a surface (the slanting plane of the thread of the screw) is driven constantly forward in the direction of the axis of the latter. When the propeller is revolving in water these surfaces move forward like oars and meet with the resistance of the water which drives them in the opposite direction.

In the same manner serpentine movements of a wave-like form traverse the body of the fish from head to tail. Each of these serpentine waves compresses the water in front of it like the blade of an oar whose height depends upon that of the body of the fish and whose breadth is equal to the amplitude of the serpentine wave. In the case of the eel, in which the height of this pseudo-oar-blade is small, the breadth must be correspondingly greater. In the carp, on the contrary the height is greater and the breadth correspondingly less; in the case of the carp, however, the effect is heightened through the fact that the waves progress with greater rapidity, the resistance being thus increased according to the square of the velocity.

Still another interesting comparison is made by Dr. Hesse between the swimming of the fish and the progress of human aircraft. Just as some of the latter are heavier and others lighter than air, so we have fish that are heavier than water and others in which the weight of the displaced mass of water is equal to that of the body, just as a lighter-than-air balloon becomes of equal weight with the surrounding air at a given altitude. The former are those fish which have no swimming bladders and especially the sharks; while the latter include all those numerous fish which obtain equilibrium by means of their air-filled floats or swimming bladders. And just as dirigibles and airplanes differ in their motion so do these two classes of fish—thus we see a gold fish in a glass aquarium floating about like a balloon, whereas a codfish sinks to the ground like an airplane when he is not moving. Furthermore, those fish supplied with swimming bladders can swim as slowly as they please, whereas a shark must maintain a definite minimum of velocity in order that his forward motion shall create sufficient resistance of the water against his underside to balance his excess of weight.

It may be observed, too, that the fish having no swimming bladders have need of special supporting surfaces in order to afford the resistance of the water a suitable point of attack; and the slower their motion the larger these surfaces must be. It will be generally found among such fish that the ventral surface is broad and flattened, rising in a sharp angle toward the point of the snout in the case of fish which swim horizontally. The fins, especially the breast fins, serve to enlarge this under surface and are, therefore, much larger than in most fish which possess swimming bladders; and are likewise much more strongly supported by portions of the bony structure.

In the case of fishes with swimming bladders the paired fins are usually employed for steering like the horizontal rudder or elevator employed to turn the airship upward or downward; and the form of the body is not subject to such limitations as in those fishes not so provided. Hence we find a great variety of forms among the former.

Another point of analogy is that just as airplanes are capable of attaining a higher velocity than dirigibles, so we find the greatest speed among the heavier-than-water fishes, *i.e.*, those without swimming bladders, examples of which are the shark and the mackerel. The muscular activity of some of these fishes for swimming is so great in fact that the internal temperature is no less than 10 degrees Centigrade higher than that of the surrounding water. When there is such a strong driving power a smaller under-surface is necessary in order to obtain the necessary buoyancy; on this account the mackerel's fins are small and capable of being pressed into grooves in the body of the fish, lessening the friction of the passage through the water.

Both sorts of fish are capable of a movement through the water which may be compared to that of volplaning. Fish provided with swimming bladders accomplish this by compressing their bladders by the action of powerful muscles, thus quickly achieving a comparative increase in weight. At the same time they spread their powerful breast fins in order to obtain a larger lower surface.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Greek Contribution to Good English

To the Editor of the SCIENTIFIC AMERICAN:

An editorial in your issue of September 11 holds up to mild ridicule certain formidable-appearing words of Greek parentage, and says of them and their brethren that they "shuffle along in the procession of our discourse as the limping, the lame and the halt in a gay parade, uncouth, incongruous."

It seems to me that this view of these useful words is somewhat like the objection to the steam shovel, that compared with the automobile it does not develop much speed. Take "schizophrenia," for instance, one of the words cited to the bar for contempt proceedings. It is not found in the edition of the Century dictionary that I own, and my medical dictionary is not by my side. Yet the little Greek I know tells me that it means a mind divided against itself—a form of insanity in which one's mentality does not coördinate. That word, and others like it, are by no means holiday paraders. They are the tools of a particular craft, never used by the flippant verbal merry-makers, but very useful to specialists. No one claims that logarithms are joy-riders; but to the surveyor in the woods, and to the skipper on the lonely ocean, they are as handy as a jack-plane to a carpenter; and to a boy who has studied Greek for a year such words as this are fairly phosphorescent in their illumination of his technical reading.

Now as to the general utility of Greek in the English language I offer in evidence the admirable article in the SCIENTIFIC AMERICAN of September 18, "New Concepts of the Past Century" by the Einstein prize essay editor. If we eliminate the Greek-derived words from that article, it can hardly be transplanted into Anglo Saxon speech. Let us see. The article says that "the classical geometer regarded his science as the study of observed phenomena, of space considered as an entity." Oh, you wise engineers and craftsmen who jeer at Latin and Greek, try to say in Anglo-Saxon English just what is meant by that sentence. The men of old England before the Norman Conquest knew about a lot of thinks like logs and dogs and hogs, but when it came to psychology and technique and characteristic phenomena, and things mathematical, analytical and philosophical, their geometry and their axioms and their postulates were missing.

We scarcely realize the influence of Greek words on our thought. Sympathy, aristocracy, eulogy, democracy, authority, character, pneumatic, kaleidoscopic, dynamic, physics, psychology—all the choruses of the choirs invisible—without the Greek our language would grovel and plod and get stuck in the mud. And the long words of the specialists, they hurt nobody who does not understand them. They wait patiently on the shelf till they are needed by someone who knows how to use them.

It is notorious that engineers and other able handlers of things tangible, when they try to explain what they mean in court and in public speech, stumble and fall down in a way that would put to shame a high school boy. When you find one who can express himself without pencil and paper and diagrams you almost invariably find him to be a man who has studied Latin and Greek, and thereby obtained a ground knowledge of his own complex mother tongue.

Washington, D. C. FRED IRLAND.

The Round-Trip Paradox

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 4th, 1920, under the caption "Wanted—A Proverb," you speak of critics of the results of the Michelson-Morley experiments. Perhaps your simple-minded critics will understand the problem of the rower up and down stream by a change of venue, so to speak.

The twelve miles rowed is between stationary points, but the rowing distance is in a moving medium and the actual points of the journey are in the water. For instance, assume a moving sidewalk traveling at the rate of two miles per hour. A man walking four miles an hour, if he walks against the direction of movement, in six hours will have advanced twelve miles from the point of the stationary platform at which he stepped on to the moving walk; but he will have walked twenty-four miles from the point of the walk at which he stepped on to it. Now if he returns, he will in two hours walk eight miles back on the surface of the moving sidewalk, but as the walk travels two miles an hour, he will at the end of his two hours be able to step off at the identical point on the stationary platform at which he began his journey. In other words, his eight-hour walk has covered thirty-two miles of the moving walk's surface, twenty-four going and eight returning, and not merely twenty-four miles, twelve going and twelve returning, as would be the case if he walked on the stationary platform from one point to another twelve miles distant on the same platform and back.

Similarly, the rower is actually traveling twenty-four miles' distance on the surface of the moving stream going and eight returning. If instead the rower traveled twelve miles on the surface of the stream each way, he would pass between two points on the bank six miles apart going, and returning would pass between the upper point and a second point downstream on the bank eighteen miles apart. Thus, in six hours he would actually traverse twenty-four miles on the surface of the stream and pass by twenty-four miles on the bank, but the two legs of his journey in the stream would be equal, twelve miles each, while the two legs of the bank passed by would be unequal, six miles and eighteen miles. To make the two legs of the bank passed by equal, twelve miles each, he has to make the two legs of his journey in the stream unequal, twenty-four miles and eight miles, the total of which, being thirty-two, is greater than in the former case, and therefore requires two hours more time. I think many people will find this the simpler explanation of the apparent paradox. R. H. FERRIS.

New York.

A section of an eight-foot steel penstock being hauled into place with the aid of a special railway track

Putting the San Joaquin to Work

Some Details of the Water-Power Development in California's Fruitful Valley

By Arthur L. Dahl

CALIFORNIA has always been looked upon as one of those States peculiarly blessed by Nature, for the wonderful resources of this sunny land embrace not only the food products so luscious and popular, but extend to vast reservoirs of minerals and oils, extensive forests, and finally enormous quantities of undeveloped water power. Mountain ranges, like a huge backbone, run through the State from Siskiyou to San Diego, and the falling waters from these mountains are capable of developing 9,250,000 horse-power of which only about ten per cent, or 942,000 horse-power has been developed to date.

Oil is produced in many different districts of California, providing a convenient and cheap source of power for all industries, for the pipe lines from the oil districts extend for hundreds of miles, bringing the liquid fuel to the refineries located on tide water, where ship and locomotive can load easily. In spite of this abundance of oil fuel, the industrial development of the State has been so rapid that all of the hydroelectric power companies have been taxed to the utmost to meet the demands for electric power, particularly for agricultural use. California is said to use more electricity on the farms of her State than any other State in the Union, most of this power being devoted to pumping water from subterranean sources to irrigate the valleys.

It is commonly said of the West that the value of land depends upon the amount of water available to irrigate it, but in the San Joaquin Valley of California the people say that the value of land depends upon getting electric power to develop it. In Kern, Kings, Fresno and other central California counties are millions of acres of level, fertile land, dry and unproductive now, for lack of surface water, but capable of being turned into garden spots by the water pumped from the hidden reservoirs, and in the conversion of these desert lands into highly productive fruit and grain lands, electric power is playing a major rôle. An electric motor is the most satisfactory and ideal source of power for pumping water, for it need not be watched or attended, unlike the gasoline engine or other power plant. For this reason the development of the San Joaquin Valley is largely dependent upon hydro-electric power, as it has been estimated that less than 10 per cent of the agricultural possibilities of this region have been developed.

In the very heart of this vast region of potential possibilities is the San Joaquin Light & Power Company, which supplies electric power to a very wide district. At the close of the war this company had a maximum generating capacity of 63,000 kw. from nine hydro-electric plants and three steam plants, and this power was inadequate to the needs of the district. During the present year the company has completed a new 12,500 kw. addition to the natural gas-burning steam plant at Bakersfield, and in September, 1920, the new 30,000 kw. Kerckhoff hydro-electric plant on the San Joaquin River, 45 miles from Fresno, was put in operation. The company plans further development of its hydro-electric possibilities so that between 270,000 and 300,000 hp. will be made available in its Kings River project, at an estimated cost of over $50,000,000.

So urgent was the demand for power for pumping that the company had on file in excess of 600 applications for power which it could not supply, and the Kerckhoff development was pushed with all possible speed to increase the needed production. Work was carried on night and day, and a number of new schemes were put into effect to expedite the work. For instance, steam shovels were used to excavate the material in driving tunnels, the muck being carried away by a 5-ton electric motor pulling the dump cars.

The project consisted of building a dam 110 feet high across the San Joaquin River at a point about 4½ miles northwest of Auberry. At this point the entire waters of the San Joaquin river are diverted through a series of tunnels 17 feet wide and 17 feet high, a distance of 17,000 feet to the forebay, located about three miles due west of Auberry, from which point the water is carried through three steel penstocks 8 feet in diameter, tapering to 7 feet at the power house, where it operates three turbines of 16,000 horse-power capacity each.

While borings were being made at the dam site, work was likewise being carried on to construct the necessary roads through the mountains for the transportation of construction material, and a complete camp for housing the men was constructed at the dam site. To get the material from the end of the newly-built road to the dam site, high above, an electric hoist was installed and an incline tramway constructed. Two steel cableways were installed, having a 500-foot span, and a capacity of 20 tons each, and these cableways were used for transporting material from the incline railroad to the dam. On one side of the site an enormous body of gravel had to be removed before the concrete foundation could be laid, and a revolving steam shovel was taken across on the cableway and used in getting rid of this gravel, which was hauled across on the cable. When it came to lay the foun-

(*Continued on page 481*)

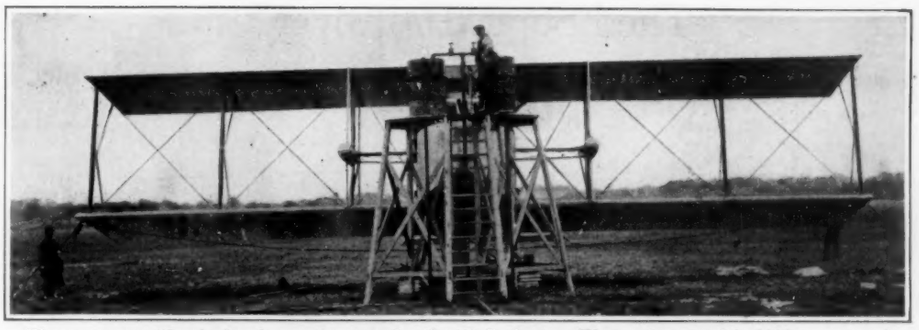
1—One of three 16,000-horse-power turbines transported over the rough mountain roads via caterpillar truck. 2—Cutting out the solid rock for the power-house site, overhanging the river and fifty feet up to guard against flood. 3—The steel penstock that carries the water to the turbines

The construction work that makes available the white coal of the San Joaquin Valley

Trans-Oceanic Airplane

Multiple Engines and Transmission Gears as Aids to Continuous Flight

SEVERAL years ago when the development of the airplane was in its preliminary stages, Mr. Edwin Gould offered through the SCIENTIFIC AMERICAN a prize of $15,000 for a successful airplane driven by two or more engines, capable of being connected up or run separately at will. The object of this offer was to promote safety of travel by dividing the total engine power among several units in such a way that the failure of one unit would not necessitate an immediate landing or loss of control.



The seven-ton Martin bomber under test by the U. S. Army. The engine speed is 2000 r.p.m., and the propeller speed 1000, yet no signs of vibration show in this photograph. Each engine may be disconnected at will from propeller shafting

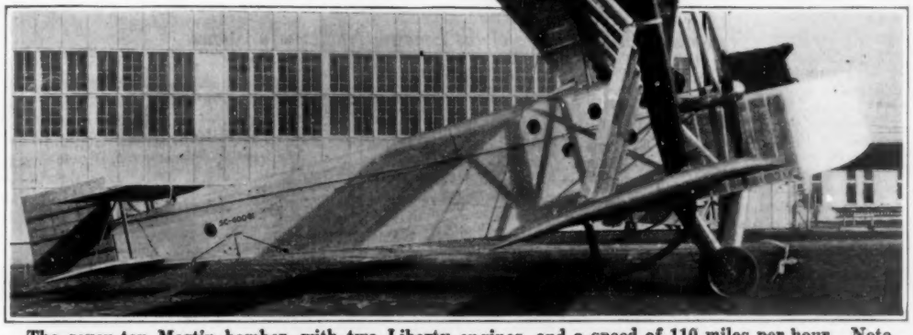
In the SCIENTIFIC AMERICAN of February 3, 1912, we published an article by Mr. James V. Martin, entitled "Can the Atlantic Ocean Be Crossed in an Airplane?" in which the writer discussed the possibilities of transatlantic flight and presented his design for a large hydro-airplane equipped with five Gnome engines connected up to two propellers, one on each side of the fuselage. The important feature of this design was the location of these engines in a single compartment at the front end of the fuselage, and the provision of clutches and a suitable transmission gear, which enabled any temporarily disabled unit to be disconnected while repairs were being made. In the intervening years, Mr. Martin has developed this system, and its latest application is shown in the accompanying photographs of what is known as the Martin seven-ton transmission bomber, which, it is needless to say, was developed for war purposes. The two photographs were taken on the army flying ground known as McCook Field, at Dayton, Ohio.

If the transatlantic airplane is ever to compete with the transatlantic steamship, it must be made absolutely safe and reliable. Passengers must go aboard the air liner with the same sense of security with which they board an "Aquitania" or an "Olympic." To secure these conditions, the promoter of airplane travel must find some way to make the motive power as dependable, even more dependable, than the motive power of the steamship. Everyone knows that it is far from being that at present, and the reason is not far to seek. It is found in the fact that if one or more of the engines goes dead, it must remain dead to the end of the voyage; for it is practically impossible to make the necessary adjustments or repairs when, as is now almost invariably the case, each engine is directly connected to its own propeller and is either placed in the open or enclosed in a shell or "egg" which is so contracted as to provide insufficient room for the mechanics.

The inventor of this machine believes, and we are inclined to agree with him, that the air liner of the future must be provided with a multiplicity of propellers connected up to a main transmission shaft, which is driven by a multiplicity of engines placed in a roomy engine compartment, each engine being independently clutch-connected to the transmission shaft, so that any engine that is in trouble can be thrown out of engagement, leaving the rest of the plant to "carry on" while repairs are being made.

The seven-ton machine which we illustrate is driven by two Liberty engines carried side by side in a closed compartment in the nose of the machine. In the accompanying side view, the hood of this compartment is removed, showing the starboard engine. When the machine is in flight and the hood in place, the mechanics find themselves in a closed engine room with fair head room and sufficient space around the engines to give them sufficient elbow room. The two crank shafts run back to a transverse transmission shaft which is geared to the inboard ends of the propeller shafts, the whole transmission being of strong and thoroughly stiff construction.

Our front view of the bomber shows the gear under test by the army at the McCook Flying Field. Because the machine was stationary for the fourteen hours of the test it was necessary to provide two tanks of cooling water which were carried on a platform as shown. Of particular interest is the clear definition of this photograph, for it was taken when the two Liberty engines were being run at 2,000 revolutions per minute and the propellers at 1,000, and served to demonstrate that a gear of this character [illegible] transmitting a total of 910 horsepower at these high speeds can be so built and emplaced that the machine shall be practically free from vibration.



The seven-ton Martin bomber, with two Liberty engines, and a speed of 110 miles per hour. Note K-bar truss and aero-dynamic controls at the wing tips

Transmission

The transmission weighs only seven-tenths of a pound per horse-power transmitted, while the mechanical loss due to the use of the transmission is nine per cent. Both of these losses are more than canceled by the propeller and motor efficiency due to the gear ratio of the transmission, which is two to one. The particular transmission used in this machine was designed and built to carry only 625 horse-power; but in this test it stood the 900 horse-power developed by the two high-compression Liberty motors when running at 2,000 revolutions per minute. The static tests extended over fourteen hours, with continuous runs of four hours; and the entire absence of vibration, together with the perfect ease with which either motor could be engaged or disengaged at high speed by the operation of its clutch, proves that this type of transmission is ideal for the heavy duty, long-distance airplanes of the future.

Reduction Gear Effect

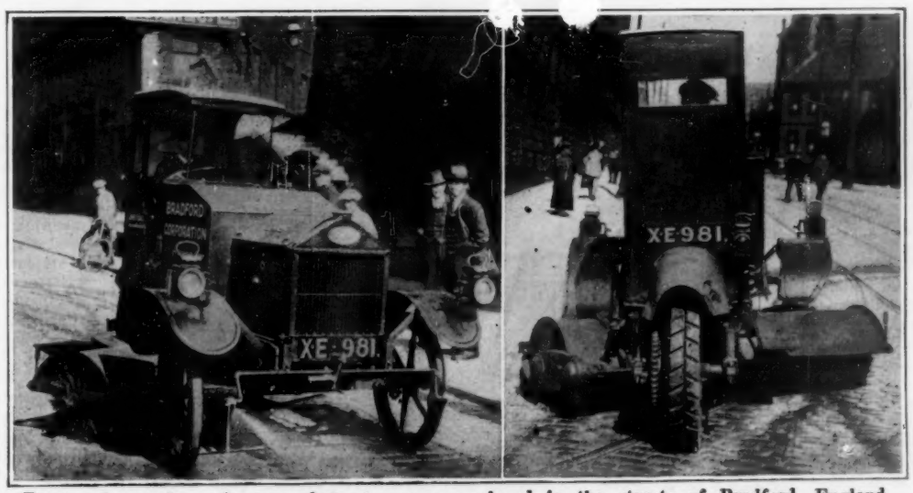
An interesting parallelism between airplane and steamship drive is seen in the fact that this transmission is the counterpart, so far as efficient results are concerned, of the reduction gear of the steamship, where efficiency calls for a much higher speed in the turbine than in the propeller. The same conditions prevail in a more moderate degree on the airplane, and the transmission as used on this machine renders it possible to run both motor and propellers at the best theoretical speed for efficiency. In the Martin bomber, should one of the engines become disabled, a clutch disengages it and the remaining engine continues to drive the plane at 74 miles an hour instead of 110. This, however, is a safe speed and permits the disabled motor to be repaired in the shelter of the cabin, after which it is started by a self-starter and then synchronized and reengaged with the line shaft.

Other features are the use of the retractable chassis and the K-bar truss and the aerodynamic control at the wing ends.

How Bradford Sweeps Its Streets

IN many ways the city of Bradford, England, sets the styles as far as the efficient running of a municipality is concerned. Bradford has long solved the street transportation problem by trackless trolleys which are models of their kind. And now Bradford is sweeping its streets by means of little vehicles such as that shown in the accompanying illustrations.

There is nothing absolutely new in the gasoline-driven street sweeper. Many of our American cities boast of such machines. The Bradford street sweeper carries sufficient water for a fair run, and the dirt is swept off into the gutters instead of being picked up in a hopper as in some of our American machines. Nevertheless, the smaller machine would seem to have certain advantages of its own, such as lower first cost and lower operating costs, not to forget its ability to work in pretty tight places, if necessary.



Front and rear views of a type of street sweeper employed in the streets of Bradford, England

The "Super-Destroyer"

Some Facts Concerning the Origin and Development of the Flotilla Leader

By Hector C. Bywater

THE flotilla leader, which is a super-destroyer, is a new type of vessel developed during the recent war. These vessels are used to lead flotillas of destroyers into action. Being larger than destroyers they carry the essential facilities for a flotilla commander. They are better equipped for signaling and range-finding, carry a heavier battery, and a much more efficient radio equipment than a destroyer. They proved themselves to be very useful in the late war, and are now generally recognized as being required by modern organization for destroyer operations. Also, these larger vessels were found necessary for screening battle-cruisers, where the ability to maintain high speed in a seaway is a prime necessity.

H. M. S. "Wallace," flotilla leader of "Scott" class; displacement 1,700 tons, making 37.7 knots at 45,500 horse-power. Armament: five 4.7-inch guns, six 21-inch torpedoes

The foregoing admirable summary of the functions of the flotilla leader is contained in the recommendations made by the General Board of the United States Navy for the building program of 1921. Five vessels of this type were included in the Board's program, which, however, has not been accepted by Congress, with the result that, for the next few years the United States Navy will have to do without a type of fighting ship which is possessed and highly prized by the other navies of the world. The flotilla leader is really an old type revived under a new name. It is the modern descendant of the "divisional torpedo-boat" and the "torpedo-gunboat" built during the closing decades of the 19th century, types which, in their turn, had sprung from the sea-going torpedo-boat and eventually became merged in the destroyer. The credit of having invented the flotilla leader must go to Germany, who some forty-five years ago ordered the "Zieten," a fast "torpedo aviso," from the Thames Ironworks of London. Although but 975 tons in displacement and barely 200 feet in length, she had a speed of 16 knots, remarkable for those days, and carried a powerful armament of four 4.7-inch breech-loading guns, with submerged tubes at bow and stern for ejecting the "fish" torpedo. The success of the "Zieten" led other powers to experiment with vessels of this type, from which there grew a very numerous family. It was only in Germany, however, that the original function of the "Zieten" as a leader of torpedo boats was kept steadily in view, though lack of funds prevented that country from perpetuating the type.

In 1906 tactical maneuvers held in the North Sea convinced the British Admiralty that the system of using destroyers in large flotillas of twelve to twenty boats necessitated the building of special leaders, or flag boats, from which the commodore in command could control his flotilla just as an admiral handles a squadron or fleet of battleships from his flagship. Since the ordinary destroyer did not offer sufficient bridge room, living accommodations, and other facilities for the commodore and his staff, it was considered necessary to design a vessel of larger dimensions, fitted up as a miniature flagship, and possessing superior qualities of speed and armament. The pioneer vessel of this type was the "Swift," ordered from Cammell-Lairds of Birkenhead, in 1906. She displaced 1,825 tons, was 353 feet in length and 34½ feet broad, and was equipped with turbine machinery of 30,000 S.H.P. to produce the then phenomenal speed of 35 knots, which was at least five knots more than the best British destroyer of the period could make. The trials of this vessel, which was launched in 1907, were watched with keen interest, as few engineers believed she would ever make her contract speed. But the first runs over the measured mile confounded the skeptics, for the best run at full power gave a maximum velocity of 38.3 knots—a world's record which remained unbroken for ten years. Her boilers were exclusively oil-fired, and the success of this innovation encouraged the British Admiralty to embody the liquid fuel system in their later destroyers. But this drawback to the "Swift" was her inordinate cost—£280,500 ($1,402,500 at normal rate of exchange). For this sum three destroyers of ordinary type could be built, and consequently no further leaders were built until 1913, in which year the "Marksman" and "Lightfoot" were laid down. The "Swift" performed most valuable service during the war, and her dashing exploit in April, 1917, when, in company with the "Broke," she fell upon six German destroyers in the Dover Strait and routed them with heavy loss, will long be remembered. Shortly before that action her original armament of four 4-inch rapid-fire guns had been changed to one 6-inch and two 4-inch, so that she was a most formidable opponent for any destroyer. Various structural modifications have now brought her displacement up to 2,207 tons, but she is still good for 35 knots.

The value of the flotilla leader is evidenced by the fact that during the war period every naval belligerent, with the exception of the United States, built many vessels of this type. Great Britain added no less than 34 of them to her fleet; Germany laid down flotilla leaders of unprecedented size and power; and both Italy and Japan evolved some very striking designs. The new French naval program includes six 2,000-ton leaders, and the U. S. Navy Department is known to have prepared plans for vessels of the same type, though their construction has still to be authorized.

The accompanying table shows at a glance the principal features of representative flotilla leaders built, building, and projected for the world's navies.

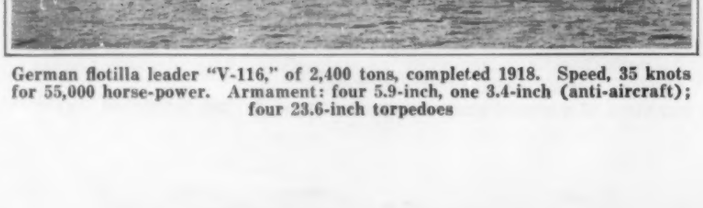
It will be seen from the accompanying list that the German flotilla leaders easily surpassed their contemporaries in size and weight of armament. These twelve boats—"S-113-115," "V-116-118," "G-119-121," "B-122-124"—were designed to form an "Iron Division," primarily for the purpose of defending the "Heligoland Bight" against British raiders and mine-layers. They are of peculiar interest, illustrating as they do the radical change induced in the German conception of destroyer functions as the result of war experience. Before the war German naval officers attached minor importance to the gun armament of their torpedo craft. Logically enough, they insisted that the torpedo was the only weapon that counted in this type, and that every ton of available weight must be devoted to speed and torpedo tubes. It was not until a whole series of their boats had been sunk or badly mauled by the heavier gunfire of British destroyers that they departed from this rigid principle. All the German pre-war boats mounted 3.4-inch 22-pounder guns, which were soon replaced by the 4.1-inch 38-pounder with a semi-automatic breech-block, enabling a very high rate of fire to be maintained. Guns of this caliber were supplied to nearly all the boats built during the war, and proved superior in range and smashing power to the British 4-inch. But it cannot be said that the German destroyers ever took kindly to artillery duels, and to the end of the war they never used their guns to full advantage.

Typical Flotilla Leaders of the Leading Navies at a Glance

	British		*German*	*Japanese*	*Italian*	
	GRENVILLE	WALLACE	V-116	AKIKAZE	AQUILA	LEONE
Number of boats in class...	6	12	12	5	4	4
Year of launch.....	1916	1918	1917	1921	1916	1920
Length over all, ft.....	325	320	360	350	315	360
Beam, ft.....	31¾	31¾	36	34	31	34
Displacement, tons.....	1,666	1,740	2,400	1,900	1,600	2,200
Shaft horse-power.....	36,000	40,000	55,000	50,000	44,000	42,000
Speed, knots.....	34	36	35	38	34	34
Fuel capacity, (oil) tons....	500	550	700	600	260	400
				4(or 5)		
Armament: guns.....	4—4 in. R. F.	5—4.7 in. R.F.	4—5.9 in. R.F.	5—5 in. R. F.	3—6 in. R. F.	8—4.7 in. R.F.
Torpedo Tubes.....	4—21 in.	6—21 in.	4—23.6 in.	6—21 in.	4—18 in.	6—18 in.

What the big super-leaders of the "V-116" class might have done can only be surmised, for none of them was commissioned in time to take an active part in the war. A great mystery has been made in Germany about these twelve boats and the details of them given in the above list have not previously been published. Five boats were completed in the spring of 1918 and ran their trials in the Baltic. Most of them exceeded the designed speed of 35 knots, but the great weight of armament and the immensely powerful machinery proved too much for the scantlings, and all five had to go into dockyard for extensive alterations, which were still incomplete at the date of the armistice. The four 5.9-inch guns were on high-angle mounts and could be used either for flat trajectory fire or against aircraft. The projectile weighed 101 pounds and contained an exceptionally powerful bursting charge, which would have proved most effective against such comparatively flimsy targets as destroyers. The torpedo armament was limited to four tubes, mounted in pairs amidships, but these fired the new 23.6-inch torpedo, which is the most powerful weapon of its kind in existence. Its warhead is charged with 616 pounds of T.N.T.—practically double the quantity of explosive carried in pre-war torpedoes—and it can travel a distance of 16,350 yards at a velocity of 28 knots. Since it would be impossible to manipulate torpedoes and tubes of this size by hand, the "V-116" and her sister boats had special motors for loading and training the tubes. They were also fitted with the latest appliances for controlling

(*Continued on page 482*)



German flotilla leader "V-116," of 2,400 tons, completed 1918. Speed, 35 knots for 55,000 horse-power. Armament: four 5.9-inch, one 3.4-inch (anti-aircraft); four 23.6-inch torpedoes

Golf Without a Caddy

By Elmer A. Sperry

GOLFERS are being made faster than caddies. Nature apparently has little to do with the former, while we are compelled to leave it very much in control of the latter. It is more and more difficult to get caddies and those who do get them find them of little account. Some seasoned golfers absolutely refuse to carry their own bag over the course. No matter how experienced they may be, they are probably far wiser than they know; there is a decidedly startling and quite unsuspected reason why caddiless golf is exhausting. An analysis of the underlying causes is of more than ordinary interest.

Everyone knows that he gets tired in toting his own golf bag, much more so than seems at all reasonable. An abundant reason for this fatigue is revealed, however, in the *dynamics* of the proposition, which involves elements heretofore neglected. Analysis reveals the fact that it isn't toting the bag that makes one tired; in fact, we are quite familiar with the energies that this factor involves. It probably requires, in the great economics of nature, about 30 watt-hours per ton-mile to cover this part of the work. This means, where a player averages 2½ miles an hour, 2½ times 30, or 75 watt-hours to be multiplied by the tonnage of the bag, which equals roughly 1/200. This equals 100/266 or for two hours a total of 200/266 watt hours, which, being interpreted, means about the power required to raise about one ton through the distance of one foot or about one foot-ton of energy. This may seem staggering, but it is quite an unimportant factor as compared with one other of much greater magnitude, and it is this latter which really saps the energy of the player, namely, picking up his bag and its constant repetition. This tires him far more than has been supposed, actually over 24 times as much as toting the bag.

In lifting, it isn't the bag that weighs, but the *man*. We have lost sight of the player's own weight which is involved in this process. Suppose the player's center of gravity is lowered 2 feet at each pick-up and raised again, and his weight is 150 pounds. He thus exerts 300 foot-pounds of energy in lifting his own weight regardless of any other factor. Again the muscular energy involved in lowering himself is understood very well and is about ¼ of the above amount, or 75 foot-pounds. Again another quantity occurs in the small amount of stooping and rising again in the act of lowering the bag to the ground before making his shot. No player drops his bag any great distance—the clubs are too valuable for this. This factor averages about 85 foot-pounds. He of course also lifts the bag itself, say 10 pounds, through three feet, giving 30 foot-pounds additional for this item. Let us now add these items and see what it amount to—300 plus 75 plus 85 plus 30 equals 490 foot-pounds. Now let us suppose the course is an average hard course and our average player requires 100 strokes to go around; he will use up no less than 49,000 foot-pounds of energy or the amazing effort of 24½ foot-tons—more if he is a tall man, again more if he weighs in excess of 150 pounds, and doubly more if he is both, as many men are. And this in only one round. No wonder the player feels himself "all in" in toting his own bag in the old way. Here is an enormous store of energy that should be conserved for the game itself instead of being utterly and uselessly wasted—and what a waste! The kind that causes exasperating delays upsetting one's own game, and what is most exasperating, often that of many others as well.

Practically all of these 24-odd foot-tons of energy per man per round can easily be saved by the simple expedient of an upstanding or stabilized bag. Put a spike in the bottom of your bag and drive it into the turf. Do anything rather than drop your sticks. Personally, I was appalled at the results of these simple calculations. Accurate information as to the real seat of a difficulty allows us to engineer around it, in fact, in this case to avoid it entirely. In my own case it is very gratifying to know the real reason for "that tired feeling" after caddiless golf and to find it not wholly due to advancing years after all. I am happy to say that I have experienced complete relief from the extra fatigue, finishing a round fresh and ready for more, by employing this simple device of the upstanding, stable bag.

In my case I have been able to accomplish this by a little attachment which I designed for my light "Sunday" bag. It weighs only a few ounces and can be readily attached or detached. This was made by my boys at the works, who seem to take extra pride in providing the boss with an energy-saving device. This

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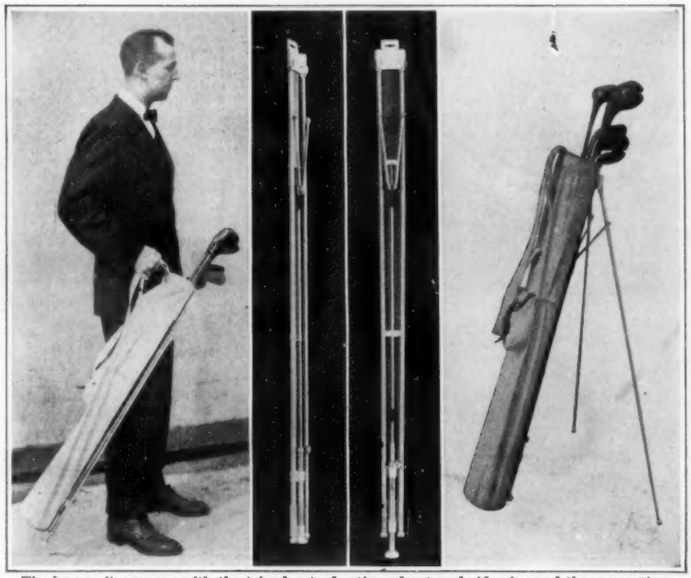


The bag as it appears with the tripod out of action; front and side views of the supporting members; and the way in which the bag stands "on its toes"

Mr. Sperry's up-standing golf bag that saves the caddiless player 25 foot-tons of energy per round

Keeping in Step

By Ralph Howard

THE latest departure in synchronous motor application is the installation of a very small self-starting motor in a clock, where it is used, in connection with a high grade clock movement, to compare the speed of a synchronous generator with exact time, in order to give a continuous check on generator frequency. Since any change in the speed of the generator is reflected in the speed of this small motor, whereas the clock speed remains constant, the combination forms an accurate method of maintaining constant average frequency.

These small motors can also be used on the system in place of clock mechanisms to drive graphic recording instruments, demand meters and time switches. By the use of this motor the synchronization of records from graphic meters and demand meters will be made possible; something that has always been desirable, but somewhat difficult of accomplishment heretofore.

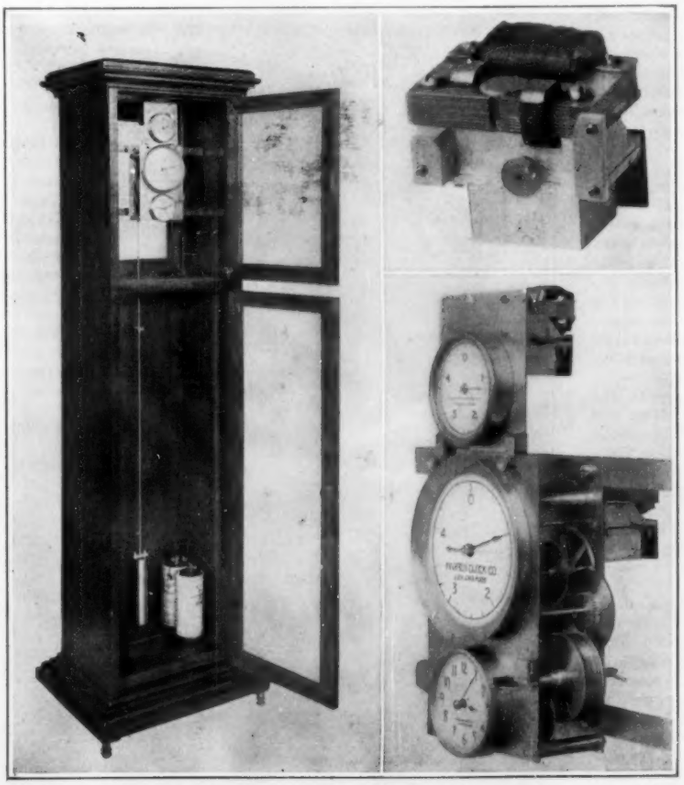
In practice, a master clock containing two movements, one electrical, and one pendulum-operated, is located near the switchboard. The face is equipped with two pointers, one black, the other gold, rotating independently about the same center, on a dial, called the operating dial. The black pointer is so geared to the pendulum clock, as to make one complete revolution every five minutes. The gold pointer is geared to the small synchronous motor, so that when the frequency is correct it will rotate at the same speed as the black hand. All that the operator has to do is to hold the two pointers together—he will then have a fixed relation maintained between standard time, and generator speed, or cycles and time. This can be done by adjusting the speed governors of the prime movers. The master clock does not obviate the use of a frequency meter, or indicator, since it will not show instantaneous fluctuations in speed. Moreover, by using a frequency indicator near the master clock, the latter may be used as a constant check on the accuracy of the former.

The little synchronous motor which is the vital part of the electric component of the clock is only 2⅛ by 2⅝ by 2 9/16 inches in size, and is wound for operation on a 110-volt circuit. It consumes less than 4 watts at 110 volts, 60 cycles, but can be made for any one of the standard commercial frequencies. It is self-starting under load, reaches synchronous speed in less than a second and holds speed as long as the current is uninterrupted. It is simple in construction, and since its gearing runs permanently immersed in oil it requires but little attention to keep it functioning properly for an indefinite period.

There have been developed two forms of master clock, known as the type "A" and type "B." The principal difference in operation of these two is that in the "B" type, both the motor and the clock mechanism act on the same index hand, through gearing, so that the synchronous motor tends to drive the hand in one direction, while the clock mechanism tends to drive it in the opposite direction.

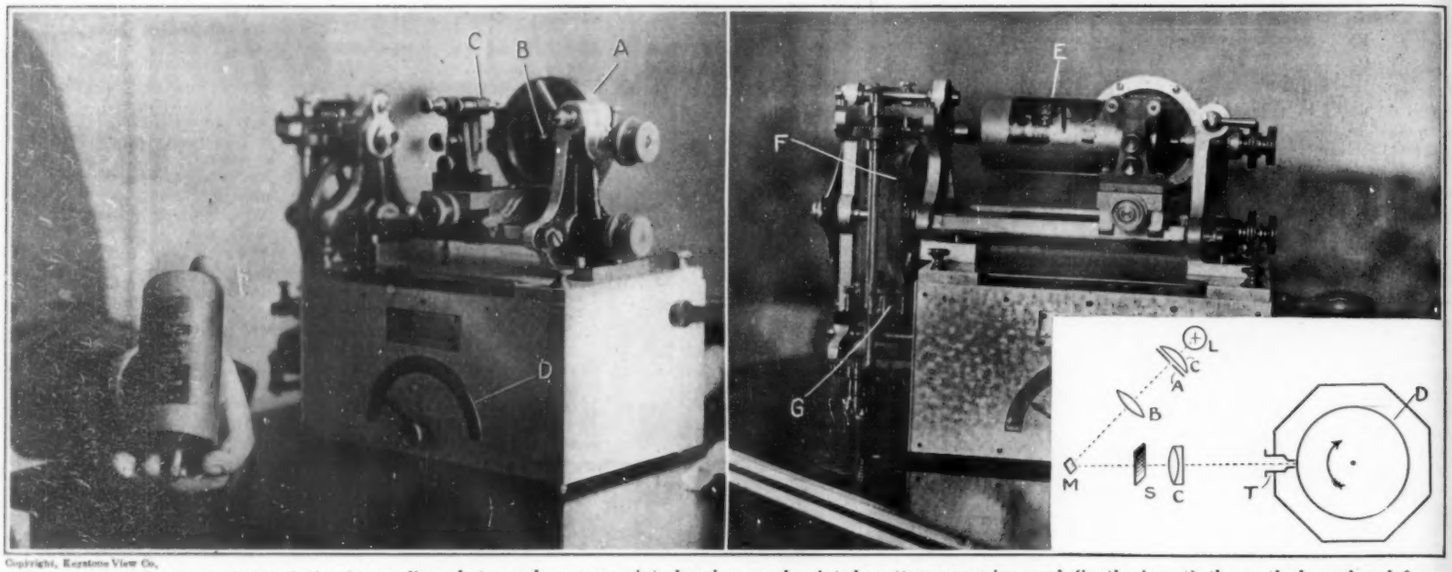
If the rate of the clock and motor are the same the hand rests at zero on the scale, but if the speed of the motor varies the hand is moved slowly in a clockwise or counter clockwise direction according to whether the variation is a gain or loss in speed. In this way the clock is caused to indicate variations in average frequency. The "A" type is that first described, in which control of the two speeds comes from comparison of two hands.

The installation of these master clocks will not eliminate fluctuations which are dependent to some degree on load variations, speed governor response, or steam pressure — features of operation which are more or less constantly encountered; but it does insure the maintenance of a more uniform as well as correct average frequency.



Left: Front view of the master clock. *Upper right:* The motor for the master clock. *Lower right:* Movement of the master clock

The motor-controlled synchronizing clock



Two views of the transmitting device for sending photographs, manuscript, drawings, and printed matter over wires and (in the insert) the method employed for translating the modulated current back into a copy of the original at the receiving end

Sending Photographs Over Wires

Details of the Belin System To Be Tried Between St. Louis and New York

By Austin C. Lescarboura

THE important happening in Shanghai is printed in the New York newspapers the following morning. Indeed, so remarkable is our news-gathering machinery of today that half the world knows precisely what the other half is doing by the telegraphed or cabled or via radio word. And in due course the first half receives photographs of the happening in the second half of the world, thus completing the account; for if there is one thing certain in modern journalism, it is that photographs tell a story incomparably better and more readily than the best word picture.

Now, then, were it possible to transmit the story and the photographs simultaneously, our news-gathering machinery would be nearly perfect. Many a fine photograph must needs be discarded for the reason that it arrives too late to be of interest to the readers of large metropolitan newspapers. There is a tremendous wastage in this direction, due to the weeks and even months which must elapse in transmission.

With the urgent need for a rapid means of transmitting photographs before us, we can turn to the efforts of M. Edouard Belin of Paris, France, with a greater sense of appreciation. M. Belin has been working on the problem of transmitting photographs over wires since 1907. After certain changes in his basic designs as well as constant refinement in all the details, he has finally achieved noteworthy results for his latest system. In fact, he has to his credit the transmission of photographs over telegraph lines between Paris and Lyons, Paris and Bordeaux, Paris and Nice, Paris and London, and Paris and Antwerp.

At present M. Belin and his assistants are in the United States for the purpose of demonstrating the telestereograph, as it is called, over long-distance lines. The first test is to be between St. Louis and New York, and is being conducted under the auspices of the *St. Louis Post-Dispatch* and the *New York World*. It may be that M. Belin will later attempt the transmission of photographs between New York and San Francisco; but at any rate, he has come to this country of vast distances in order to put his system to the acid test, so to speak.

The first attempts at telegraphic transmission of autographical texts go back to the work of Abbé Caselli in 1860 and the device known as the Pantelegraph Caselli. The first attempts at the transmission of photography are attributed to the German, Professor Korn of Munich, who made use of selenium but later on, in a modified system, returned to a scheme very similar to that of Caselli. In the case of M. Belin the selenium and other delicate elements have been replaced by more practical means. The transmission is simply a matter of preparing a bas relief of the photograph, and then tracing that bas-relief with a stylus connected to a telephone transmitter. The latter varies the current flowing over the telegraph or telephone line in accordance with the relative height of any point on the bas relief record at any given moment. At the receiving end this current variation is translated into various gradations of light in the manner described further on.

The first step, then, is to prepare the transmitting record or plate. A copper cylinder forms the base of the record, and its surface is coated with a 5 per cent shellac solution. Meanwhile a carbon print is made in the conventional photographic manner from the photographic negative to be transmitted, after which the print is wrapped face to face with the shellacked copper cylinder. The cylinder with the print is then placed in hot water, with the result that the gelatine of the print adheres to the cylinder in accordance with its own degree of blackness, while the unexposed gelatine is washed away with the paper. In this manner a coating of uneven thickness is formed on the cylinder, or a photograph in bas-relief.

Reproduction from a photograph received by M. Belin's apparatus. Note that in our half-tone reproduction considerable detail is lost

The copper cylinder is then placed in the transmitting device which bears a close resemblance to the cylinder type phonograph. As will be noted in the two illustrations of the same transmitter at the head of this account, the components of the transmitter are: *A*—A special microphone with a stylus *B*, which is in constant contact with the face of the cylinder. *C* is another form of stylus, about which we shall have more to say further on. *D* is a speed regulator, controlling the clockwork which drives the transmitter. *E* is the copper cylinder with the photograph in bas-relief. The cylinder, it will be noted, can be inserted or removed with as much ease as the changing of cylinder records on the phonograph. *F* is a two-speed gear transmission, driving the cylinder. *G* is the synchronizer, which causes the receiver to keep in step with the transmitter by a series of electrical impulses sent over the line.

As the copper cylinder revolves, the microphone, with its stylus always in contact with the record face, is slowly moved along the record, touching practically every part of its surface. As the unevenness of the surface depresses the microphone stylus more or less, the current flowing through the microphone is modulated so as to correspond with the varying density of the photograph.

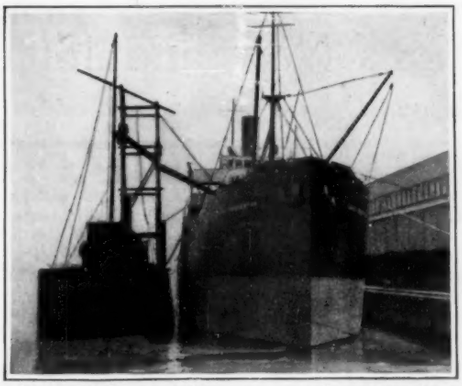
The receiving end must translate these electrical variations back into the original photographic terms. This it does in the manner indicated in the line drawing which forms the insert of the two illustrations at the head of this account. First of all, we have a special form of diminutive arc light shown at *L*, which sends its rays through the condenser *C* and the aperture *A* and again through the lens *B* on to a tiny mirror *M*. The mirror is mounted on the twin wires of a Blondel oscillograph—an apparatus with powerful electro-magnets and a pair of silver wires which carry the oscillating mirror, located in the powerful magnetic field. The Blondel oscillograph is a highly sensitive apparatus, and the immersion of the wires in thick oil causes the action to be practically "dead beat," or, to put it in another way, the wires have little momentum. As the current of varying intensity comes over the wires to the receiving set, the wires of the Blondel oscillograph cause the tiny mirror to turn more or less on its axis. However, no matter how far the mirror may turn, its reflected beam still passes through the screen *S*, the lens *C*, the almost microscopic aperture at *T* and on to the sensitized surface on the cylinder *D*.

The whole crux of this apparatus is the screen *S*, which is a screen of varying transparency. That is to

(*Continued on page 483*)

From Coal Barge to Ship's Bunker

A COAL barge with an elevator and chute has made its appearance in San Francisco Bay and has as a purpose the direct coaling of a ship while the cargo is being unloaded, obviating the necessity of the ship's proceeding to a bunker wharf to receive its fuel. Instead of the usual clam-shell bucket, such as is used at bunker wharves, the coal is sent up on an elevator and slides down a chute into the ship. A donkey engine on board operates the elevator.



This coal barge delivers its coal directly to the ship by means of an elevator and chute

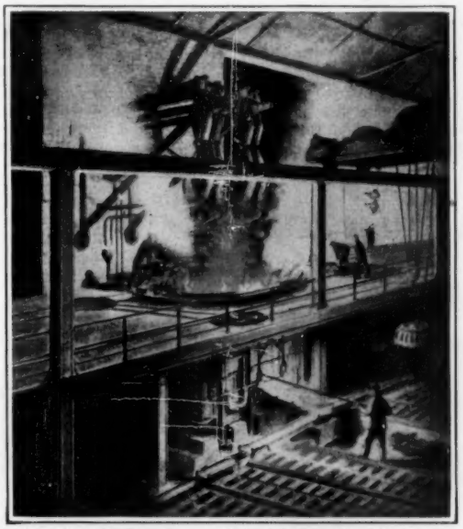
Converting Steel Back Into Iron

CONSIDERABLE has been said and written about making steel in the electric furnace, which is a development of the last four years. Not so much has been promulgated about making pig iron from steel in such a furnace. It is standard practice to make pig iron, from which all steel is originally made, by smelting iron ore in a blast furnace and thus reducing or converting it to metallic iron, so-called, in the shape of pig iron.

A new and unique method has recently been developed however for converting scrap or old steel *back* into pig iron. Why this is done or even is necessary needs explanation first. At times certain kinds of pig iron are hard to obtain as made by standard methods. This has been true lately in Canada and France. It was therefore necessary to make it by a new method if possible.

The illustration shows how this was and is done in France. It represents a French electric furnace for converting scrap steel back into pig iron, something never thought possible nor probable only two or three years ago. Scrap steel or borings or turnings are charged from the upper flat form into the top of the furnace shown. Electricity is conducted into this furnace by the apparatus suspended from the wall. When the crude steel is melted certain additions are made to it so as to increase the percentage of carbon, silicon, etc., and very soon after the mass is tapped out at the bottom, as shown, in the shape of pig iron. It can be seen flowing into systematic molds made in a bed of sand. When cold it is removed and is called "pig" iron because each section of iron is attached to the central larger section or trough much as pigs gain their sustenance from the mother sow.

Many tons of such iron has been made in both France and Canada and it is regarded as, or can be made, the finest pig iron of any.



An electric furnace used in France for the purpose of converting scrap steel back into pig iron

The Motorcycle's Future

NOW that the former British and German motorcar owner has to be content with the more modest motorcycle, we may look for a considerable development along the lines of general utility and cheapness, says a writer in a British technical review.

Before the war the tendency of the motorcycle, under American influence, was towards increased weight and horse-power, and consequent complexity. Now, however, the chief considerations are safety, lightness, and simplicity to meet the requirements of the average man, who wants a cycle that will start up without causing him undue exertion, that can be lifted up and down steps and is not prohibitive in price or upkeep.

The lines on which improvements should proceed are, above all, toward simplification and comfort. The belt drive, a fruitful cause of breakdown, must be eliminated, the various parts simplified and their number reduced, the lighting system should be made as elementary as possible, and all complicated control on the handle-bars suppressed. Special care must be given to the brakes and the saddle should be made adjustable to the rider's comfort.

Another paramount necessity is that wheels should be made easily removable, in view of rendering the repair of punctured tires as simple a matter as possible, and there is plenty of scope for improvement in the tires themselves. High speed is not required, therefore the engine can and should be as light as is compatible with reliability. The development of the motorcycle as the plain man's vehicle also promises a future for the autowheel and motorscooter.

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Austrian suits for workmen, a damask luncheon cloth and a laundry bag—all made of paper

Shall We Wear Paper Clothes?

BEFORE we part with a good share of our yearly income for a serge or woolen suit, it may be a matter of real wisdom to look into the paper clothes situation. At any rate, the Bureau of Foreign and Domestic Commerce has on exhibition a large assortment of Austrian paper clothing and associated paper articles collected for the information of the American clothing and other interested industries. The exhibit includes workmen's suits, table covers, collar and cuffs, laundry bag, wall decoration, twine and other articles.

In this interesting collection there is a suit made of 40 per cent paper, which sells in Austria for 575 crowns, or about $2.65 in American money at the present rate of exchange. A workman's all-paper suit in brown is quoted at 32 crowns, or about 15 cents in American money. A blue all-paper suit is more expensive, 120 crowns (about 55 cents) being the asking price.

The report which accompanies the paper samples states that the garments are really washable, cold water, soap, and a scrubbing brush being the proper means. It is also reported that during the past year Austrian paper goods manufacturers have exported large quantities of their output to Italy and to Turkey. A previous report spoke of about 40,000 German paper suits being on display in a store on the Strand, London. After a brief stay in the Bureau of Foreign and Domestic Commerce, the paper articles will be offered to clothing and other interested manufacturers for examination.

A Grass Lawn Like a Carpet

IT is proverbially a slow business getting a good grass lawn in a garden, but a new English idea makes it possible to secure a fine stretch of verdure just as one would buy a carpet at the stores. Grass seed is sown thickly on strong canvas and, when this is thickly covered with growth it is ready for making the lawn. The site is well prepared, being made perfectly level and special attention is given to getting the soil so that it is a favorable rooting medium for the little plants. Then the grass mats are put down on sections, these being closely fitted together. As time goes on the roots push down through the canvas and, in this way, establish a permanent lawn. Ultimately the material will rot. The value of this plan lies in the fact that an immediate effect can be secured. It is quite easy to have a splendid grass lawn in a situation where, a few hours before, there was nothing of the kind. From thenceforward the grass will go on improving and the little plants speedily take a hold on the soil.

A New Kind of Coal

HERE is a new suggestion as to fuel—a new kind of coal. It is especially timely with coal at the high prices at present obtaining. The idea comes from Norway and is the result of experiments carried out in a plant at Greaker, Norway, where an improved process has been employed to produce sulfite coal as a by-product from the manufacture of wood pulp.

A ton of wood pulp yields 9 to 10 cubic meters of sulfite lye, of which 95 per cent is available for the production of coal, compared with about 60 per cent from other processes. If the new process is generally adopted it is estimated that it will be possible to produce annually sulfite coal equivalent to 800,000 tons of imported coal.

Considerable quantities of cheap alcohol are produced from the wood pulp lye before it is made into coal. An essential feature of the new process is high concentration of the lye before removal from the autoclaves. By concentrating it to 30 per cent not only is a high percentage of coal-producing substance obtained, but the quantity of solid matter is increased by 50 and even 70 per cent.

A Fountain for the Cows

THE average dairy cow drinks anywhere from 60 to 100 pounds or more of water daily—in fact unless she gets plenty to drink, her milk yield will be visibly reduced. That is why dairy farmers devote particular attention to equipping their farms with all the modern facilities—somewhat in the nature of dairy cow soda fountains—for satisfying Bossie's thirst.

One eastern farm has provided durable concrete water tanks in each field where the cows are pastured. The tanks are connected directly with the farm water supply, a float being placed in each tank so that the water level is maintained at the same point all the time. Considerable trouble obtained due to the fact that the cows would nose and damage the floats so that they would not work properly. Then the owner devised the type of tank shown in the accompanying picture which provides a sort of square-shaped nub at one side of the tank for the float and the inlet and overflow pipes. An iron framework is provided over the top of the compartment so that the cows cannot reach or touch the float with their noses. Now Bossie and her mates never lack for fresh water as the dairy never runs dry.

This concrete fountain serves fresh water to a herd of cows without attention of any kind

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

This side car can be attached or detached in a few minutes and adds little to the weight of bicycle

The Bicycle with the Side-Car

THE bicycle is by no means obsolete in most European countries. Indeed, the shortage of gasoline and the economic situation as a whole have caused the European to hold on to his bicycle or even to go back to such a vehicle, while his more progressive and more fortunately situated American brother has gone on to automobiles, motorcycles, cyclecars, scooters and whatnot.

A recent European development is the side-car for bicycles, as represented by the accompanying illustration. Here is a side-car especially suited to the man who wishes to take along his child. The passenger may be up to seven years of age. The body has two large springs and ensures comfort in riding. It is provided with a windshield and a top. The body, which can be quickly attached or detached from the bicycle, adds very little weight to the latter.

A Folding Air Pump for the Motorist

AN air pump which folds up into a small space and can be slipped into any tool box has been introduced by an Illinois manufacturer. The pump is operated on the leverage principle and it is claimed that it will force air against a pressure of over 250 pounds. Increased power and increased leverage are developed with each stroke. It is constructed of pressed steel and has no stuffing box. The only parts present in the compression chamber are a steel plunger with a heavy cup leather. Although the cylinder is quite short it is claimed that the friction is nominal and the pump has no tendency to heat. A 30 x 3 tire may be inflated to 60 pounds pressure in 60 strokes.

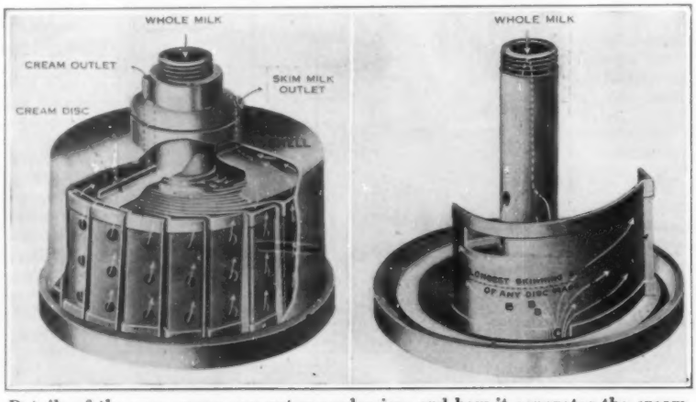
The new folding pump as it appears complete folded and ready for use

Something New in Cream Separators

THE separation of cream (butter-fat) from the whole milk is due to the fact that the milk particles, being heavier in weight than the butter-fat particles, are thrown outward by the terrific centrifugal force exerted by the revolving of the bowl anywhere from 9,000 to 15,000 turns per minute.

Heretofore all disks in cream separators have been of the cone-shape design. The whole milk, flowing in at the top, has had to travel downward, between these numerous disks placed but ⅛-inch or less apart. Naturally, with this extreme velocity, and due also to the fact that both milk and butter-fat particles enter at the extreme edge of the disks, not all of the butter-fat particles can get out of the way, or, in other words, back up against this tremendous pressure, and are therefore carried along and out into the "skim-milk." This causes quite a loss of cream.

But there is now on the market what is known as the "straight disk"; the whole milk flowing first to the bottom and then entering each disk at its center, which, as shown in one of our drawings, gives the butter-fat particles *B* a chance to slip back toward the cream outlet, and out of the way of the heavier milk particles *A*, thus producing a separation that is practically 100 per cent.



Details of the new cream separator mechanism and how it separates the cream from the milk

Revival of the Merchant Marine

DURING September, for the first month since the armistice, according to returns of the Bureau of Navigation, Department of Commerce, the increase in the American seagoing merchant marine owned by American shipowners has equaled and exceeded the increase in the Government-owned ships. At the last session Congress in the appropriation bills changed the war policy and directed the Shipping Board to maintain itself by sales of ships and shore property without further appropriations. During September the fleet of seagoing ships of 500 gross tons or over of American shipowners rose to 1,829, of, 4,625,324 gross tons, an increase during the month of 25 ships of 116,335 gross tons, while the Government-owned tonnage during the month increased only 20 ships of 88,855 gross tons, giving a Shipping Board total of 1,698 ships, of 7,288,208 gross tons, on October 1. Since January 1, 1920, however, the Government-owned tonnage has increased by 233 ships, of 1,347,466 gross tons, while the commercial marine of American shipowners has increased only 129 ships, of 536,926 gross tons.

A Poison-Gas Gun for the Law-Abiding Citizen

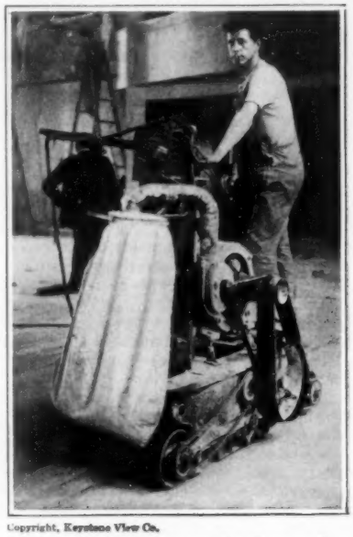
THE good citizens of Paris seem to have taken the initiative in the war on criminals which must be fought in order to suppress the tidal wave of crime that has swept almost all countries since the termination of hostilities and the disbandment of large armies. It has remained for some ingenious Frenchman to produce a liquid poison-gas pistol, which is shown in the accompanying illustration.

This little instrument of protection for the law-abiding citizen has been inspired by the war. It has the advantage of putting an adversary *hors de combat* immediately, but without evil effects of any kind. The gun contains liquid poisonous gas which, if it strikes the bandit, puts him to sleep at once. Again, if it strikes the bandit in the eyes it blinds him for several days.

The handle of the gun contains the liquid poison which is compressed with the aid of a bicycle pump at the lower end of the handle. All one has to do is to point the gun at the target at a distance of not more than ten feet, and press the trigger which releases a thin stream which is accurate at that range. The liquid, emitting poisonous gases, disarms the bandit.

A Machine that Refinishes Floors

KEEPING any large dancing floor in first class shape is no small job, especially in the usual manual way. It has remained for inventors to produce a floor-scraping machine of the type shown in the accompanying illustration, which, driven by a powerful electric motor, travels over the floor, shaves off the old surface and smooths the new one, and then sweeps up all the shavings and dust into a bag at the rear of the machine. This machine makes the job of keeping floors in good shape relatively simple and inexpensive, particularly in these days of high labor costs.



This machine scrapes the floor and refinishes it, gathering the shavings in the bag

Recent Patent Decisions

Phonograph Horns.—This case involves a patent of a horn for phonographs, the body portion of which is composed of longitudinally arranged strips of metal provided at their edges with outwardly directed flanges whereby said strips are connected, and whereby the body portion of the horn is provided on the outside thereof with longitudinally arranged ribs, said strips being tapered from one end of said horn to the other.

The complainant in this suit seeks to restrain the defendant from making, using, or selling phonograph horns infringing its patent issued to Peter C. Nielsen. It further seeks the profit realized by the defendant, and damages. The defendant denies liability on the ground that it did not infringe under any permissible interpretation of the patent, that the claims of the patent, if not wholly invalid, are entitled to a narrow construction only by reason of prior art patents and publications and prior state of the unpatented art.

Held that the Nielsen patent is valid. A patent for a device which performs a novel and useful function, as the horn in question for phonographs which did

(*Continued on page 484*)

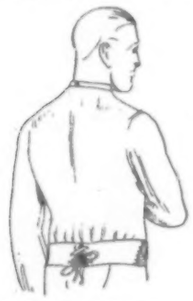
This pistol shoots a stream of liquid poison gas which puts a bandit hors de combat

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

SHIRT.—J. P. MULLANE, 17 Ellsworth Ave., Cambridge, Mass. Among the objects of the invention is to provide a shirt which is practically tailless and which in lieu of the ordinary



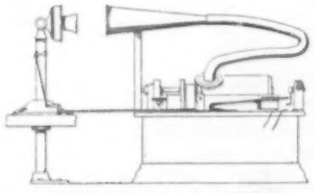
A REAR VIEW OF THE SHIRT IN USE

tails is provided with a belt which forms a part of the shirt and which fits snugly around the hips; the shirt is also provided with ventilated inserts below the arms which increase the wearing qualities, and add to the comfort of the wearer.

SLIPPER.—M. GAETO, 429 E. 127th St., New York, N. Y. This invention more particularly relates to a sole and heel construction which are adapted to be sold in combined form and have any desired upper or vamp attached. A further object is to provide slippers especially designed as bedroom slippers and the like and which will be strong and durable and easily assembled by any one of average intelligence.

Electrical Devices

AUTOMATIC BURGLAR ALARM.—F. A. TERRY, Marshfield, Ala. The invention relates to burglar alarms comprising a telephone set and a phonograph disposed near the set, with brake mechanism for holding a switch hook



A SIDE VIEW OF THE DEVICE

in normal position, a motor, an electric circuit for operating the motor, and completing the talking circuit. An object is to provide an alarm which will send in a call for help over a telephone whenever put into operation by the opening of a window or door.

Of Interest to Farmers

TAPPED WHEEL FOR PLANTERS.—C. L. HEATH, 2432 Cullom Ave., Chicago, Ill. The features of this invention are to provide a practical manner of actuating the seed dropping mechanism for check row corn planters which will do away with clutches, spring tension devices, friction devices, and other complicated means for effecting the desired result. This check row device may be conveniently applied to various makes of planters without materially departing from their original construction.

Of General Interest

PENCIL.—H. L. BLACKMAN, c/o Parker Pen Co., Janesville, Wis. The invention pertains more particularly to that type of pencil in which a lead is fed longitudinally of the body of the pencil. It is the prime object of the invention to provide a novel form of lead-feeding mechanism and lead holder, and further to construct a pencil of this type which has the fewest number of working parts.

DEVICE FOR CONSERVING CORD AND TWINE.—O. A. GALE, Eaton, Ohio. The invention relates to means for conserving cord of odd lengths, especially in connection with post office and like work. An object is to provide a movable rack which has a plurality of spring clips, into which odd lengths of cord or twine may be sprung temporarily so that they may be within reach for reuse, thereby avoiding the waste of much material.

GAS SCREEN.—T. A. BROOKS, Newton, Kan. The object of the invention is to provide a device adapted for use in connection with gas burners, for spreading and intensifying the flame. The screen may be used on any kind of stove in the ordinary manner except when gas pressure is extremely low. Then the vessel can be placed on the lugs of the screen.

SPOOL.—A. H. SCHLOERB, 94 W. 104th St., New York, N. Y. The invention relates to spools or winding cores upon which silk thread, yarn or other products of thread manufacturers may be wound or spun. It is an object to provide a simplified form of spool construction of paper or other very light weight material which will be cheap to manufacture and which will enable the thread manufacturer to inexpensively place silk thread upon the market.

BOOKKEEPER'S WORK TABLE.—B. P. REESON, 23 So. Park St., Box 185, Sapulpa, Okla. The object of the invention is to provide means whereby accountants and book-

A PERSPECTIVE VIEW OF THE INVENTION AS IN USE

keepers can have their books within convenient reach without leaving their seat. Another object is to provide a device wherein the various books can be kept convenient for use, and in which the books can be stored and then transferred to a safe or vault.

POWER-OPERATED RAZOR.—W. A. FUSCH, 129 Merchant St., Decatur, Ill. Among the objects of the invention are to provide a razor which will simplify and shorten the usual process of shaving which will dispense with the necessity of lathering the face, which will not require the usual keen cutting edge, which is self-sharpening to a considerable extent, and which will cut the hairs in proper and close manner without injury to the skin, and will leave the skin in a healthy condition.

COURSE FINDER.—C. N. WESTWOOD, 1015 Princess Ave., Victoria, B. C., Canada. The invention has for its object to provide an instrument by means of which courses may be easily found and corrected. The device comprises a blade, a mariner's compass card mounted to rotate on the blade, a fixed indicator on the blade coöperating with the compass card, and an arc-shaped bar adjustable transversely of the blade and carrying indicators at its ends coöperating with the card.

MEANS EMPLOYED IN PRODUCTION AND MATERIAL CONTROL SYSTEM.—E. H. BICKLEY, c/o Bickley Mfg. Co., 1033 Chestnut St., Philadelphia, Pa. This invention relates to a chart for use in connection with a system for the control of production and material in a factory, although not necessarily limited to this use as it can be applicable to wholesale houses or other mercantile requirements. The system is so flexible that it will control and can easily be adapted to any kind of factory, regardless of the nature of the product.

FLASH LIGHT BAG.—G. A. LEY, 1627 Carmen Ave., Chicago, Ill. The invention relates to photographic apparatus. An object is to provide a flash bag including a supporting staff running from the crown of the bag to the lower ends of the bottom ribs inside of the bag, thereby keeping the flash which is created in the flash pan supported by the staff, a safe distance from the bag. A further object is to provide means for employing the smoke by a flap falling back automatically to uncover an opening when the bag is turned over.

FIRE FIGHTING APPARATUS. — J. C. WITT, 300 Main St., Pine Bluff, Ark. An object of the invention is to provide a portable and collapsible fire shield to be used adjunctively with the usual fire fighting apparatus, the shield being controlled in its erection and collapse by the telescopic action of the truck upon which it is mounted. Another object is to provide fire curtains at the sides of the supporting truck, with engine driven gear connections controlled by the operator, for raising and lowering the curtains to protect the working parts beneath the truck.

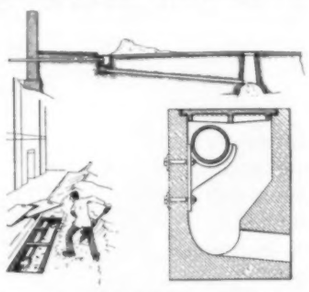
Hardware and Tools

PACKING AUGER.—O. R. HYLAND, Box 680, Astoria, Ore. The object of this invention is to provide an auger especially adapted for packing comminuted substances in bags, as, for instance, flour and the like, wherein the arrangement is such that when the bag is filled with the required weight the vanes of the auger will be automatically thrown out of packing position into a position to check the further flow of matter to be packed.

Heating and Lighting

FURNACE GRATE.—M. T. DAVIS, JR., Box 1244, Charleston, W. Va. An object of the invention is to provide a sectional grate for furnaces, provision being made in each of the sections for the circulation of water so that the heating area of the furnace is greatly increased. The sections consist of vertical hollow rear branches, and forwardly and upwardly inclining bottom branches, nipples securing the various sections together and affording water communication there between.

SNOW REMOVAL AND STEAM HEATING SYSTEM.—W. F. GUERIN, 1914 69th St., Brooklyn, N. Y. This invention relates to means for the removal of snow and has reference more particularly to a snow removal and steam heating system, which includes a steam



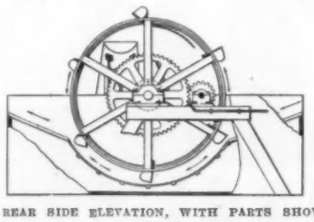
SHOWING THE ARRANGEMENT OF THE SYSTEM WITH RESPECT TO A STREET

pipe located adjacent the points where the snow accumulates, the steam pipes being adapted to melt the snow and cause the resulting water to flow away. An object is to provide means for quickly freeing streets and side walks of heavy snow falls.

Machines and Mechanical Devices

ROAD SCRAPER.—C. M. DICUS, Gaffney, S. C. This invention relates to road scrapers of the type suitable for use upon country roads and of such form that it may be readily operated at a comparatively low cost. The scraper is a comparatively simple machine and can be pulled by horses or by a gasoline tractor and can be operated by one man.

SAND SEPARATING APPARATUS.—H. L. HAMILTON, c/o Iowa White Co., 1719 Grand Ave., Des Moines, Iowa. The invention relates to apparatus used in gravel and sand washing plants. The object is to provide a sand separating apparatus arranged to effec-



A REAR SIDE ELEVATION, WITH PARTS SHOWN IN SECTION

tively separate the same from the water without loss of even the finest sand. A further object is to provide an apparatus capable of a large output in a comparaitvely short time and without unduly increasing the operating expense.

Musical Devices

TAMBOURINE.—I. LEVY, c/o Michthauser & Levy, Java, Provost and Kent Sts., Brooklyn, N. Y. The primary objects of this invention are to so construct a tambourine as to materially reduce the cost of manufacture, and to render the same more durable than tambourines as usually constructed. The instrument comprises an integral flange defining one edge of the main body, and provided with a plurality of cut-out portions, and sound-producing elements mounted in the cut-out portions.

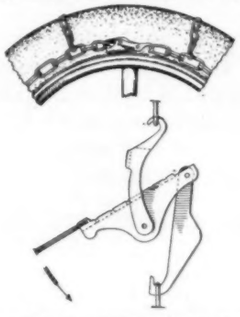
Prime Movers and Their Accessories

AUTOMATIC FUEL MIXTURE REGULATOR.—A. A. LOETSCHER, Hotel Carlin, Billings, Mont. The invention relates more particularly to an automatic fuel feed regulator for internal combustion engines. An object is to provide an automatic fuel mixture regulator under the control of and responsive to the speed of the engine to effectively vary the proportion of the hydrocarbon or other combustible and of the air whereby the fuel mixture or charge delivered to the cylinders is accurately proportioned for perfect combustion and maximum power at all engine speeds.

BOILER.—J. P. PERRY, Glencoe, N. Y. An object of the invention is to provide a steam boiler design which will have a great deal of heating surface and which will be comparatively small in size, in order to provide a suitable boiler for use on airplanes, automobiles, and other vehicles, and which will also find a use in any capacity where it is necessary to produce steam for operating steam engines and turbines.

Pertaining to Vehicles

CHAIN CLAMP AND TIGHTENER.—G. J. WIEDMAN and J. H. HUGHES, 202 Mont Bldg., Lewiston, Mont. This invention has for its object to provide a chain clamp and tightener, especially adapted for securing non-skid chains



A SIDE VIEW OF CLAMP PARTLY OPEN, AND CHAIN CLAMPED ON TIRE

on motor vehicle tires, wherein mechanism is provided for easily and quickly tightening the chain and clamp in place beyond the possibility of accidental opening.

BRAKE ATTACHMENT FOR AUTOMOBILES.—H. W. HAAPANEN, 224½ St. Jean St., Detroit, Mich. Among the objects of the invention is to provide a device having elements or shoes which engage with the road bed, for positively stopping the automobile or preventing skidding, and which may also serve as a supporting means to retain the tires elevated from contact with the bed when the machine is not in use.

BASE FOR JACKS.—A. E. HUTCHISON and H. KRAH, 372 Monroe St. Brooklyn, N. Y. This invention pertains more particularly to lifting jacks especially employed as an accessory of motor vehicles. In jacks of this type difficulty has been experienced in maintaining the jack in true vertical alinement during the lifting operation. In this device a rigid base is provided, capable of removal, and with securing means which may be adjusted with respect to the base.

Building Out the Bubonic Plague

(*Continued from page 466*)

an open door and had climbed five stories up an elevator rope.

As a result of the cutting off of their food supply, old, slick rats that had grown wise and cautious became daring and reckless when starved and hungry, and were then more easily trapped and poisoned.

Board sidewalks, old stable and warehouse floors were torn up and nesting and hiding places destroyed. Concrete took the place of wooden walks and floors. Some buildings were ratproofed by the use of concrete walls that extended for two feet under ground, while other buildings were ratproofed by elevation. Sides of doorways were lined with metal so that no rodent could chew its way through.

Warehouses in San Francisco have been vastly improved since the days of the epidemic. Amended building ordinances have provided for concrete floors in basements, ratproof foundation walls and rat screens on all openings in foundations. Owners have found that these improvements were paid for in a few seasons by the elimination of loss from rat depredations and the subsequent saving was clear gain.

It took the united efforts of the people of San Francisco together with the aid of the Federal Government and millions of dollars in money fighting day and night for more than a year before the epidemic was stopped and the last plague-ridden rat destroyed. At times upward of one thousand men devoted their entire time to the work. It was estimated that more than two million rats were trapped, poisoned and otherwise put to death.

Following the outbreak in San Francisco there was an epidemic of bubonic plague in New Orleans in 1914. The latter city however, had the advantage of the experience gained in San Francisco, consequently the work was carried on more intelligently from the start. Notwithstanding this it cost the city of New Orleans eight millions of dollars and fifteen months of hard work in ratproofing buildings and wharves with concrete and metal and destroying rats.

Aside from the danger of bubonic plague, the rat is responsible for an annual economic loss that is staggering, within the confines of the United States alone. The destruction occasioned by these little four-legged vandals is so immense as fairly to bewilder one who reads the figures for the first time.

Mr. David E. Lantz, assistant biologist of the Bureau of Biological Survey for the United States Government, estimated in 1917 that the total annual loss from this pest would amount to at least $200,000,000. With the present greater value of food stuffs and materials that are subject to rat damage, the loss will undoubtedly reach nearer $300,000,000 per year at this time. The yearly rat damage in various cities in 1917 was estimated by the Biological Survey, after careful investigation, for Washington as $400,000; for Baltimore, $700,000; for Pittsburgh, $1,000,000. The Woman's Municipal League of Boston announced in 1917 that the annual loss in that city from rat depredation would amount to $1,350,000.

A professional rat catcher in Los Angeles recently estimated that the number of rats in that city would at least equal the human population. As there are approximately 700,000 people in Los Angeles, one can get an idea of the rat colony in that one city alone. It was estimated by investigators in Los Angeles that the destruction of food and other property by these little marauders would average one and one-half cents per rat per day. In seaport towns where there are extensive wharves as in New York, Boston, New Orleans and San Francisco, there are probably many more rats than people.

The people who live in the country suffer a loss from this source as well as those in the city. In one field of over one hundred acres of corn raised by boy scouts, rats climbed six feet up the stalks to reach the ears and destroyed approximately ten per cent of a large crop.

The brown rat, which is the variety that predominates in this country, owing to its ferocity, strength and fecundity multiplies with alarming rapidity. The young female rat breeds when three or four months old. If food is plentiful, they will breed from six to ten times per year and produce in the middle part of the United States about ten young to the litter. The period of gestation is twenty-one days.

The economic loss caused by the rat concerns us all. It is quite natural for the merchant, the manufacturer and the farmer to include this leakage in their cost of doing business, along with interest on the investment and other overhead expense. They must have some profit in any event. The final goat—the ultimate consumer—eventually pays the bill. But the cities of San Francisco and New Orleans have demonstrated that the rat menace can be effectively checked by building it out.

Airbrakes for the Automobile

(*Continued from page 467*)

Our first photograph shows the accumulator valve. This water-jacketed valve is usually installed in the priming-cock opening on any one cylinder of the engine and maintains automatically a constant, dependable pressure in the reservoir. A small quantity of air (or spent gas) is forced through the accumulator valve at each explosion stroke until the pressure in the reservoir balances the pressure in the cylinder. The accumulator valve then remains closed until the reservoir is reduced or excess engine pressure is generated. About twenty or thirty revolutions of the engine are required to raise the tank pressure high enough to balance the engine compression. After this pressure is reached, no loss in engine efficiency will occur, but the effect on the engine is not noticeable even when the tank is empty.

When coasting down a long hill, the engine may be shut off as usual, and the compression will generate ample pressure to control the brakes properly. If for any reason the hose should break the brake will be automatically applied.

Automobile Signals for Danger Spots

(*Continued from page 467*)

switch out of gear before the wheels reach the main operating tread so that the motor will pass on silently in speeding away from the signal and danger.

The signal is designed so that it can be operated either by electricity or mechanical means. The average automobile wheel traveling at a speed of 20 miles an hour remains on the tread only one one-hundredth of a second. On this account it has been necessary to develop a time switch to prolong the action of the signal to from one to ten seconds. In the electrical signal efficient use has been made of a weighted fly wheel operated by a pawl from the main shaft. This four-inch fly wheel is hung on ball bearings and carries a cam for raising or lowering a brush, the arrangement being such that when the fly wheel comes to a balance, the brush is insulated or the current is broken. The ratchet which is worked by means of the pawl has only two teeth corresponding to the balance or rest of the wheel and the occasional dead center which may occur. The end of the pawl clears the fly wheel when it is rotating. Its purpose is to prevent the possibility of the signal light, bell or horn operating continuously if accidentally the tread should happen to be pinned down under a stationary car. The signal itself responds only to a heavy blow and will

not work when only gentle pressure takes place on the tread.

It is to be hoped that this signal will not be robbed of its effectiveness in the same way that the ordinary caution signs have been spoiled, by being posted at all sorts of trivial supposed "danger spots." When one runs over a road which is posted "Danger Ahead," "Caution," "Run Slowly," etc., at the summit of every ten-yard declivity and at the neck of every slightest twist in the roadway, the best intentioned driver in the world cannot help acquiring a feeling of contempt and disregard for these superfluous warnings. They should be reserved for the places that are really dangerous and really more or less blind, so that whenever one comes upon them one may be assured that there is really something ahead, beyond what is immediately obvious. The finest warning in the world is worthless if cheapened as are the danger signs in many parts of New Jersey and Pennsylvania.

In addition to this device, Asheville, as one of our photographs shows, is in enjoyment of a procedure which might well be made universal and compulsory. When the street is wide enough to permit it, practically all municipalities require parking of cars perpendicular to the curb instead of parallel thereto, since this at the same time makes it possible for any car to get in and out without disturbing other cars, and furnishes accommodations for considerably more cars. But in most places where we have observed this convention, it is customary for the cars to back in to the curb and park front to the street. Asheville, as our picture shows, enforces the reverse procedure, which is altogether good, since it is much easier to run into the narrow passage between two cars when going forward, while the process of getting out again, once the car is in, is equally easy whether performed forward or backward. This is a convention which might well be universally copied.

Putting the San Joaquin to Work

(*Continued from page 470*)

dation for the dam, the entire stream of the San Joaquin River was diverted by excavating a cut 30 feet wide and 250 feet long, the water being led away by a flume carrying the water to a point below the dam, after which the water again resumed its nature channel. This diversion enabled the men to work in the dry bed of the stream, and construction was pushed with great speed. The dam is built in the form of an arch, and is approximately 36 feet thick at the bottom, and has a maximum radius of 200 feet. Across the entire crest of the dam are mounted Taintor gates 20 feet in width and 14 feet in height, through which the entire flow of the San Joaquin River during flood can be handled without backing up the water to interfere with the operations of plant No. 1 of the company, approximately 2½ miles upstream. Power for the construction work was secured from this plant.

Material for the concrete work was obtained from the immediate site of the dam, as excellent supplies of rock were found there, and a crushing plant, with a capacity of 25 yards per hour, was installed. By placing this crushing plant on the side of a hill all the material handled was moved by gravity through chutes, placed at 55 degrees slope, thus avoiding the necessity for elevators.

A fleet of 14 motor trucks of from 2 to 5 ton capacity carried the freight from the nearest railroad to the incline tramway, and since it was found necessary to sprinkle the roadway on account of the dryness of the earth, a pipe line was laid along the entire distance of road built and water wagons kept the dust laid at all times.

Work on the tunnels was carried on at five different points simultaneously, and as removing the tunnel muck proved too slow by hand, steam shovels were in-

stalled and these loaded directly upon dump cars which were hauled away by electric locomotives, trains being made up of five or six cars. Except where water was encountered in large volume, some of the tunnel crews made as high as 12 feet a day, and the work of drilling and mucking went on simultaneously. A heading, approximately 8 feet high and the full width of the tunnel, was carried approximately 7 feet ahead of the bench. As soon as the shooting from a preceding shift had been completed, the steam shovel men immediately commenced to load out the muck which had been blown back from the face. The machine men and chuck tenders at the same time start work on the top of the muck and shovel back the material which still remains on top of the bench. By carrying a short bench, it is possible to clear the same with a minimum amount of hand mucking, thus enabling the drilling in the face to proceed at the same time that the steam shovel is mucking out the heading. This makes it possible for the tunnel work to proceed through the entire 24 hours of a day.

At one of the tunnels a different method of work was adopted. Here the crews were divided into drilling and mucking gangs, and worked separately. A car was specially built upon which was mounted a column 17 feet high with a jack on each end, with 4 cross bars mounted on the same, the drills being mounted on the cross bars. By this method the entire face of the tunnel was drilled and shot before the steam shovel started to work, and each crew worked in shifts. By this method a maximum speed of 90 feet in one week was obtained. Considerable rivalry existed between the various crews, and as the progress made by each crew was posted, the men working in the different tunnels endeavored to outdo each other with the result that excellent progress was made in all departments.

The three penstock lines are of riveted steel pipe, 7 feet in diameter at the lower end and 8 feet in diameter at the upper end, at which point they are concreted into the mouth of the tunnel. A forebay 17 feet in diameter at the top, 80 feet in height and 40 feet in diameter at the top of the tunnel, has been excavated in solid rock a short distance from the outlet of the tunnel, where the penstock joins the same. The purpose of the forebay, from which a spillway leads to the river, is to take care of surges due to sudden increases and decreases in load at the plant.

From the power house a 110,000-volt transmission line about 75 miles in length carries the current to a point near Tulare Lake, where it is delivered to the distributing system for use where needed. Since the hydroelectric lines of all California companies have been connected up for emergency use, it is possible to send power generated at one point to any part of the State for use.

The "Super-Destroyer"

(*Continued from page 472*)

the guns, including director aiming and firing mechanism. It is, however, doubtful whether all this cumbersome and intricate gear was suitable for vessels which were simply enlarged destroyers, and therefore exposed to the sort of rough and tumble fighting in which headlong dash counts for more than science. Moreover, experience in other navies shows that the 5.9-inch gun, with its 101-pound projectile, is much too heavy to be conveniently manhandled on the slippery decks of a boat which is moving all ways at once. In theory, the German "V-116" leaders ought to have made short work of any destroyers they were likely to meet in the North Sea; in practice they would probably have been beaten by the smaller British boats armed with the handy 4-inch and 4.7-inch gun.

A particularly formidable type of flotilla leader is represented by the five new Japanese boats of the Akikaze class, building under the estimates for the current year. They will displace 1,900 tons and have a speed of 38 knots. Four, or possibly five, 5.5-inch 82-pounder rapid-fire guns will be mounted on the centerline, and all six torpedo tubes can be trained on either beam. A feature of these boats is their large fuel capacity, which is expected to give them a cruising radius of 3,500 sea miles at economical speed.

It will be seen that the modern flotilla leader approximates to the light cruiser in dimensions and armament. If the recent rate of progress is to be maintained, "boat" will soon become a misnomer, and we shall revert to the "torpedo cruiser" of thirty years ago, though on a much larger scale. In the destroyer and flotilla leader, as in every other type of fighting craft, each new demand for increased armament, speed and sea endurance involves a corresponding increase in size, and there is practically no limit except in the paying power of the nations concerned. But in every class of fighting ship there comes a stage of development which fulfils all reasonable requirements, and beyond which it is unnecessary to go. In the case of the flotilla leader this stage appears to have been reached in the smaller designs set forth in the table shown. War experience has demonstrated the all-round tactical efficiency of such vessels as the British Scott class, which, on the relatively modest displacement of 1,740 tons, combine in a high degree the essential qualities of a destroyer flagship. It is of interest to learn that a tentative design prepared at Washington last year provided for a vessel of 1,800 to 1,900 tons, of 37 knots speed, armed with four 5-inch rapid-fire guns and eight torpedo tubes.

Golf Without a Caddy

(*Continued from page 473*)

in fact works out much more wisely than anticipated; when a few ounces can save upward of 25 tons as above, the ounces are certainly working at some high efficiency Think of the perspiration and utter exhaustion that would overtake one were he compelled to go out and raise 25 tons to the height of 1 foot by hand twice a day. How much of either energy or inclination for golf would a man have after such an exertion, or by taking the stairs climb about 30 stories in one of our tall buildings twice a day? And this is exactly what caddiless golf has been doing to us without our ever suspecting it.

With the little device I have referred to, the simple act of resting the bag down on the ground causes it to develop legs which keep it upright and very stable, and with my eye on the ball and without looking around, I am able simply to reach back, grasping the bag, and the act of lifting it from the ground causes the legs to disappear and the bag looks like any ordinary "Sunday" bag and is little or no heavier.

Another point that I have found important is the following: We all know that "keep your eye on the ball" is even more necessary after the shot is made than while making it, *if you have no caddie.* It is then the player's job to watch the ball—certainly no caddie is watching it for him. Again, one often loses the lie of the ball in the rough while stooping down to get his sticks, thus causing exasperating delays. I have found that it is certainly of surprising convenience to have the sticks right at hand, standing upright "on their toes," so to speak; and to simply reach back, grasping the bag while watching your ball, and be off on the next stroke toward the drop long before the ball lights. This is of great aid in holding your position on the course and I find often aids a whole foursome to hold its position in play. The unerring location of, and getting right off on the ball is certainly an aid, both directly and indirectly, that can hardly be overestimated.

Sending Photographs Over Wires

(Continued from page 474)

say, at one end it is absolutely opaque, but going toward the other end it becomes steadily more transparent until it reaches practical transparency. Thus the stylus attached to the microphone at the transmitting end is at a given moment on a black or high spot of the cylinder, and transmits a heavy current over the line; and this heavy current at the receiving end causes the mirror to be so pointed that the beam of reflected light strikes the opaque end of the finely graduated screen and thus fails to make an impression on the sensitized receiving cylinder. In this case the receiving cylinder will receive an impression, and using it as a photographic negative any number of positive prints can be made. It also follows that if the graduated screen is reversed, or if the polarity of the Blondel oscillograph is reversed, the receiving cylinder can be made a photographic positive.

So much for the general details, but there are numerous refinements, as might well be imagined, in an apparatus capable of accomplishing such delicate work. The aperture through which the beam of light passes on to the receiving cylinder is of microscopic proportions and is made in a silver disk which presses against the recording surface. This hole is of a size corresponding to the pitch of the feed mechanism, so that the light record, made in the form of a continuous spiral, has its threads so close together that it forms to all intents and purposes a solid photographic exposure. Otherwise the spiral would have marked spaces between the turns, which would destroy the usefulness of the received photograph.

Obviously, the transmitter and receiver must operate in step or in perfect synchronism, otherwise serious distortion results. To this end a special device is used at the transmitting end, for the purpose of starting the cylinders at both ends at the same time. When one cylinder gets a little ahead of the other, a special arrangement causes its retardation until the other cylinder has caught up so to speak. This feature of the system comprises special contact members and solenoids.

The cylinder of the receiving apparatus can take a piece of film or a strip of sensitized paper, and the emulsion of either can be of such speed as to take care of the rate of operation. The cylinder is contained in a metallic case of octagonal shape, the loading of same being accomplished in a dark room. By means of a number of cylinders and containers, the receiver is operated in a manner quite suggestive of the conventional camera and plate-holders.

Regarding the rate of transmission, which is obviously an all-important factor when the main arteries of the world's communication system are to be leased for the purpose of transmitting photographs, M. Belin tells us that this is a question of quality and fineness of detail. Some photographs are not so detailed as others, hence the transmission can be done on a somewhat coarser scale. And even the finely detailed photograph can be transmitted at a faster rate if it is permissible that the copy at the receiving end be of coarser quality. Detailed photographs can be faithfully transmitted in from four to eight minutes each, while coarser photographs or those which require rapid transmission can be handled in three to six minutes. M. Belin hopes for even more rapid transmission in the near fuure.

Something has been said about another contact-making device, indicated by *C* in one of our photographs. This device is intended for the transmission of matter in straight black-and-white, as distinguished from the half-tone graduation of photographs. In this case a given piece of writing, type matter or drawing is transferred on to the copper cylinder with the aid of a special ink, thus leaving a raised impression after drying. The contact-making member *C* is simply a make-and-

break device actuated by its stylus pressing against and in constant contact with the copper cylinder.

At the receiving end the graduated screen is replaced by an opaque screen which has a single vertical slit. This arrangement means that the mirror has only two positions so far as the sensitized receiving drum is concerned, namely, shining through the slip and on to the sensitized surface, or striking the opaque plate and thus making no impression on the sensitized surface. In this manner straight black-and-white matter can be transmitted at a high rate of speed and the reproduction must necessarily be quite faithful. M. Belin told the writer that he had transmitted cartoons, manuscript and type matter with excellent results. Photographic proofs of printed or other matter measuring four by six inches can be transmitted in four to eight minutes, and M. Belin has under construction machines which will assure the transmission of 10,000 words of text in printed form per hour.

Aside from its application to modern journalism, which is obviously the main purpose to which all electro-photographic transmission systems can be put, there are other uses. One which suggests itself to us is in the transmission of police photographs for the identification of criminals. Such a use would prove invaluable in the running down of criminals. Then there is a distinct legal use for such a system, in the transmission of facsimile evidence, signatures, and so on. There is also a military use. Perhaps, too, the system might be put to public use, permitting anyone to transmit photographs over telegraph and telephone wires to distant friends, although it would seem that the cost of such messages must remain quite high for a long time to come.

The same system can be applied to radio, by coupling the Belin apparatus with the usual arc, high-frequency alternator, vacuum tube or other type of continuous-wave transmitter. All in all, this system is applicable wherever wires or wireless or even cable is now employed in the transmission of human thoughts.

Recent Patent Decisions

(*Continued from page 476*)

away with the annoying tintinnabulations, is entitled to protection, where the specifications disclose the method, even though the inventor is ignorant of the scientific principles involved.

Where a person, by anything which he does or says, or abstains from doing or saying, when it is his duty to act or speak in respect of a subject matter, intentionally causes or permits another person to believe a thing to be true, and to act upon such belief otherwise than he would have acted but for that belief and he so acts, and materially changes his position in respect of the matter to his detriment, then the first person is not allowed, in a suit between himself and such other person, to deny the truth of the thing done or stated. Also, delay in prosecuting other infringers while the validity of a patent is in active litigation does not constitute laches or negligence. —*Searchlight Horn Co. v. Victor Talking Mch. Co. U. S. D. C. of N. J.*

Patents Used by Contractor.—This is an appeal to the Court of Last Resort of Arizona, and the decision and opinion of the Supreme Court of Arizona touches upon a matter involving patent law. The case was one brought by sureties on bonds against a street cleaning contractor concerning a series of controversies involving many issues.

It is held that a patentee or owner of a patent has the right to charge a reasonable royalty or license fee for the use of a patented material or process, and that without procuring from the patentee or owner of a patent the right to use the patented material or process there can be no lawful use thereof. Royalties due from a contractor for the privilege of using a patented process for combining materials used in bitulithic paving, and machinery used in connection with laying such material, held covered by the contractor's bond conditioned on contractor's payment for materials furnished for the improvement. That the owner of a patent process did not file agreement to furnish all the material and give license to use of patents at definite price as required by specifications did not preclude the owner from recovering from contractor's surety for royalties due where the price was reasonable and neither the city nor property owners objected.—*U. S. Fidelity & Guar. Co. v. Calif.-Ariz. Const. Co. et al. Supreme Court of Ariz.*

Eliminating the Flash From Rifles and Big Guns

THE production of smokeless powder at once rendered the art of locating the enemy's batteries comparatively difficult. However, such location often remained possible at night because of the flash observed upon the firing of the gun. A French scientist, M. Delpech, now proposes to suppress these telltale flashes, and his report upon the matter was not long ago laid before the French Academy of Sciences.

The ball of flame which is formed at the mouth of the gun is a result of the violent and instantaneous combustion of masses of carbon monoxide and of methane, which take fire upon coming into contact with the air, where they form a detonating mixture with the oxygen of the latter, whereupon a second explosion produces the luminous flash. If experiments be made with a "75" gun for example, with different powders, it will be seen that the flash of light is always produced with powders that employ at a high temperature of combustion, while with powder employing a lower temperature of combustion the flash is diminished in intensity. When a naval "75" which is longer, is desired, the gases are not ignited, since they are too much cooled by their passage through the longer barrel. In the same manner it is found that the same gun cartridge will produce a flash or not produce it according to whether the barrel of the rifle is short or long. These observations at once suggest the method by which the flash may be suppressed—in one way or another the gases must be cooled. One way of doing this is by adding, to the charge of powder, salts which contain water of crystallization and therefore exert an anti-thermic effect. Or the cooling may be accomplished, on the other hand, by physical instead of chemical means; and M. Delpech has demonstrated that the flash can be extinguished by the addition of 20 grams of vaseline to the charge of powder. In certain kinds of guns it is sufficient, indeed, merely to apply a plentiful coating of grease to the projectile. No change either in the pressures or in the speed of projection takes place but the flash is extinguished.

The suppression of the flash is more difficult in the case of big guns, because the mass of gas formed is so enormous. But it can be successfully accomplished, according to this investigator, by greasing the entire surface of the cartridges with grease or vaseline (20 per cent of the weight of the powder). These flameless powders were first obtained in 1917, and have given entire satisfaction ever since the time when at M. Delpech's suggestion the diminution in the liberation of heat was compensated by a corresponding increase in the weight of the powder (4 per cent). The anti-flash effect is obtained by introducing 2 per cent of vaseline into the powder. The suppression of the flame is complete with the guns experimented upon. The vaseline in no way modifies the firing action, the pressure and the rate of speed remaining unaltered; furthermore, the vaseline is found to exert a powerful stabilizing action upon B powder.—By *M. Tevis.*

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to Correspondents are printed from time to time and will be mailed on request. Please write your queries; do not telephone them, please.

(14345) W. S. A. writes: I was interested in Lieut. C. C. Harshman's account of "A Moonlight Rainbow" in your issue of July 3rd. This phenomenon is considered to be rather rare, but I saw one in England many years ago. This was a perfect bow, but lacked the coloring seen in the solar rainbow. I have always understood that lunar rainbows are colorless, but Lieut. Harshman does not refer to this feature in his account. A. Lunar rainbows are rare occurrences. The moon must be near its full and not far above the horizon for one to be seen. The bow will be on the opposite side of the horizon from the moon. Lunar halos are frequent on the same side as the moon. If early in the evening the bow will be in the west and the moon in the east. The writer has seen two lunar bows, both in the same evening, and about a half hour apart; faint colors could be seen red and yellow as he recollects. Never more than three are recorded, red, yellow and green, and it may be that some of these are to be ascribed to the imagination. As the writer recalls it, the lunar bow is spoken of in a very old book, "The Phenomena of the Four Seasons," by President Hopkins of Amherst College. He says in substance that a person may not expect to see more than one in a lifetime, ranking it with the wonderful coloring of autumn leaves, and a grand ice storm of winter with all the colors of the spectrum brought out in the ice crystals by the sun shining upon an earth covered with wonderful crystals.

(14346) J. C. asks: Could you please tell me the critical temperature of hydrogen, carbon, boron, aluminum, or any element? Understand I mean the *critical temperature*. 2. Could you state the thermal energy of the sun per square yard at our earth's equator? 3. Could you give me any information on the way the American Telephone Company has so increased the voice amplitude in apparatus? Is it by means of a new coil in wiring—as there are only two coils in wiring, to wit: Henry's coil and Pupin's coil—do you know if there's a new coil brought out by the aforementioned company's engineering staff? A. 1. The critical temperature of hydrogen is given in the Smithsonian Physical Tables as —240°.8°C. and the critical pressure is 14 atmospheres. There are no critical temperatures given for the other elements which you name: carbon, boron and aluminum, in the tables quoted above. Critical temperatures belong only to gases and these elements vaporize only at very high temperatures. Aluminum boils at 1,800°C., carbon is computed to boil at 3,600°C. and is known to volatilize without melting in the electric oven, while boron volatilizes without melting in the electric arc, the temperature of which is that of the carbon vapor which conducts the current across the space between the electrodes by its ionization at not less than 3,500°C. The figures given are from the tables quoted above, excepting the last for the temperature of the electric arc. 2. The Solar Constant of Radiation, as it is termed, is about 1.95 calories per square centimeter per minute, as given in the latest book upon the subject, "Abbott's Sun." Dr. Abbott is director of the Smithsonian Astrophysical Observatory and our highest authority on the subject. This number is the same for any place on the earth since it is the heat energy outside of the atmosphere received by a surface at right angles to the rays of the sun. Of this quantity perhaps 5/8 reaches the earth's surface, the rest being absorbed by the atmosphere. Of course the amount of absorption varies with the dust in the air and the angle of incidence upon the surface of the earth. 3. The amplification of the telephonic current is not produced by coils principally, although transmission to a distance was brought about by Pupin by securing resonance of the telephonic circuit by the addition of coils to the circuit. Amplification is

due to the vacuum bulb or audion, which is the invention of Dr. Lee DeForest. The radio engineers of the Western Electric Co., the U. S. Bureau of Standards and others worked out the system during the war by which wonderful amplification of the voice in the telephone and the wireless telephone became possible.

(14347) H. J. S. asks: Will you be kind enough to send me information on the following? From time to time there have been articles published in newspapers and magazines concerning the so-called "Edison Star." This star was supposed to be sent up from the Edison laboratory. The fact has started quite a discussion and while I read several articles including one of recent date by Garrett P. Serviss in the N. Y. American stating no such thing ever existed, the question remains unsettled. Will you be kind enough therefore to advise me whether or not such a star exists or ever existed? A. While Mr. Edison was working out his system of electric lighting at Menlo Park, New Jersey, some bright intellect started the story that he was in the habit of hoisting a light at early candle light and lowering slowly a little later in the evening. This light was actually seen from New York, it was said in the west. This was Mr. Edison's star. The light was seen in the west all right, but it was not an electric light over Mr. Edison's laboratory. It happened that at that time the planet Venus was bright in the western sky a little after sunset, and slowly sloped to the west setting in late twilight. It was the evening star which gave currency to the tale of the brilliant inventor of the story. This was in 1873-1876, and it seems the story is not dead yet. Nor is it likely that the truth will now overtake the lie. Professor Serviss is quite right, although he makes no explanation.

(14348) W. G. C. asks: I have read many times the theory given for hail storms, the idea being that the wind blowing in a rotary motion carries the rain drops high up in the cold air and back again into the rain cloud and so on but I have never seen any reason why we should get our hail storms after very warm weather for several days. The idea occurred to me that during very warm weather a large amount of very dry air might rise and gather high above the earth. When a shower comes up and rain falls through the very dry air this air absorbs a large amount of moisture or really produces rapid evaporation and intense cold on the same principles as the evaporation of gasoline in the auto carburetor produces cold. My idea was that rain passing through this layer of air after it had been chilled and absorbed all the moisture it could would be frozen and fall as hail. Could this be possible? A. The theory that hail stones are carried up and down several times before fallin from the cloud is based upon the fact that there are usually in them several layers of ice separated by softer material, more like snow. It seems necessary to suppose that the mass has passed from a colder to a warmer region several times before it beame heavy enough to fall out of the whirling air. It is not thought that the ball passes from one whirling mass of air up into another but that it is whirled up and down in the hail cloud itself. It would be difficult to see how the stone could pass out of the whirl in which it was borne into dry air and back again to be carried up and down in this way several times. That it takes on material which is frozen hard after it is received can hardly be doubted. It may be that your conception of a mass of hot and dry air below the cloud is correct. It can easily be worked into the ordinary theory of the formation of hail stones. Any theory must account for the several layers of harder ice which are found in the large stones by cutting them open.

(14349) T. D. asks: Can a sail boat be sailed so that it will travel faster than the wind, if so, how will it be headed? Will a sail boat travel faster directly with the wind than in any other position? A. A sail boat cannot move through the water as fast as the wind which drives it, since it must move its own weight of water out of its path every time it moves its length. A sail boat makes its best speed with the wind abaft the beam, or on the quarter as it is called. This subject is fully discussed and figures given for different sizes of boats in the leading editorial of the SCIENTIFIC AMERICAN of July 31, 1920.

(14350) H. J. P. asks how to refine platinum filings. A. Spread out filings on a large piece of paper and go through carefully with a pair of tweezers to get any solid pieces of gold and platinum, then sift well through a strong steel magnet. Speaking of magnets, see that there is plenty of strength; do not

use an old one that may have been in a factory a number of years and be played out. Having gotten a good one, always keep a piece of steel on the two ends to keep the magnetism from running out. In passing the magnet through small atoms of gold and platinum will adhere to the iron or steel filings. These may be put into an old pickle crock (sulphuric acid and water), which will eat the iron or steel and precipitate the precious metals. When a sufficient quantity is recovered these filings are placed with the others for separaitng. If a lot of oily waste, buffs, etc., are in the stuff to be refined, the same should be put into an iron pot or large iron frying pan and burned out over a gas plate before putting the magnet through. After separating, place in a large evaporating, porcelain dish and to every ounce of filings add three ounces of chemically pure muriatic acid and one ounce of nitric acid. While any quantity of filings may be treated yet it hardly pays to put less than 20 ounces through at a time. If filings are largely gold, the acids, which are previously mixed in the proper proportions, should be added slowly and a little at a time for a rapid action would result in the mixture rising and spilling over the edge, thereby losing some of the metals. The dish should be placed on a sand bath over a gas plate burner and should be kept hot. A glass funnel may be placed over the dish to prevent loss. When all is dissolved, which may be ascertained by stirring with a glass rod, turn off the gas and let cool. Then pour into large crock in which are ten or fifteen quarts of rain or distilled water or water which has been boiled and cooled. Let stand a few hours, or until next day, and a precipitate will be found on bottom of crock. This is chloride of silver. Carefully siphon liquid into another crock, or pass through a funnel with filtering paper to recover any articles or silver which may be still in the liquid; mix up about 20 ounces (for 20 ounces of refinings) of fresh powdered sal ammoniac in a little water, pour in liquid and stir well. In a few hours the platinum will be found on the bottom of the crock. The liquid is siphoned off into a fresh, clean crock, filtered to recover any further traces of platinum and with the precipitate well dried and subsequently melted in the regular furnace. The gold is recovered from the liquid by adding about an equal bulk of water and dissolving about 20 ounces of sulphate of iron (green copperas) in a little water, add and stir thoroughly. Let stand for a few hours, pour or siphon off liquid and the gold will be deposited in bottom of crock in the form of a muddy brown sediment. This is collected, dried and melted in regular crucible. The liquid will contain traces of all the metals, also the copper used in alloying, so should be poured into sink for further recovery by the refiner. The metals recovered this way are not chemically pure, only commercially so, and are used in the general run of jewelry manufacturing. It is safe to assume that in the melting of platinum all traces of silver, copper, etc., are destroyed as the high temperature would cause these metals to volatilize so that only probably metal remaining would be iridium. Sometimes this metal is not dissolved and it is thrown down with the silver. To separate, dissolve the silver in nitric acid only, dilute well with water and hang in a few pieces of copper, old boiling out pans will do, and in a day or two the silver will be thrown down when it may be dried and melted with a little borax. The iridium, trace of platinum, etc., not being attacked and dissolved by the nitric acid are recovered from the bottom of crock and melted. If all details are carefully carried out, the average shop can get out its own filings. In mixing and adding filings to acids in the first operation, the acids must be well heated before action, especially on platinum, takes place. The acids must be well put in dish first, well heated and the filings sifted, in a little at a time, stirring well with a glass rod, so that metals are constantly exposed to the acid. The amounts of sal ammoniac and copperas (20 ounces each) are for about a like weight of the metals and should be, of course, reduced or increased in proportion. All work with acids should be done in a separate room or where there is a large chimney to carry off fumes. Some refiners use oxalic acid in place of the sal ammoniac; results are the same. To be sure of getting strength it is best to buy sal ammoniac in lump form and pulverize it as mortar is required.

(14351) A. D. McN. asks: Will you please tell me whether creosoted wood is an electrical conductor or an insulator. A. Creosote is an insulator, and wood treated with creosote would have higher insulating value than when untreated.

NEW BOOKS, ETC.

"Practical Engineer" Electrical Pocket Book and Diary for 1920. London: The Technical Publishing Co., Ltd. 18mo.; 755 pp.; illustrated.

This familiar British annual comes of age with this issue, which maintains the usual practical balance between the comprehensive and the compact. Great Britain has recently sought to relieve inventors by a new Patent Act: its main provisions will be found here, with many other up-to-date additions and revisions. The buyers' guide in French, Spanish and Russian is a markworthy and helpful section of the little book.

Motionism. By E. J. McCarthy Morris, F.R.C.S. London: The Caxton Press, Ltd. 12mo.; 130 pp.

"Motionism" is an attempt to explain the visible world, and to furnish an acceptable foundation for a universal religion or ethical philosophy, by taking as starting-point a simple experiment from which the author arrives at a "trinity" of matter, mind and motion.

Silver. Its Intimate Association with the Daily Life of Man. By Benjamin White. New York: Isaac Pitman and Sons.

The author, a British economist and statistician, sets before us the story of silver, from mining, extraction and marketing to its consumption by the arts and industries and its use as currency. He pays a compliment to the annual report of the Director of the United States Mint as "the principal, one might almost say the only, authority upon world statistics." The interesting little work quotes freely from this source.

Acids, Alkalis and Salts. By G. H. J. Adlam, M.A., B.Sc. New York: Isaac Pitman and Sons. 8vo.; 112 pp.; illustrated.

While this handy little book devotes some space to theoretical considerations that initiate the student into the study of chemistry, its aim and end is rather instruction in the commercial and domestic importance and uses of these wonder-working substances. Its facts are simply and interestingly put before the reader, and form a very good introduction to further study.

Employment Psychology. The Application of Scientific Methods to the Selection, Training and Grading of Employees. By Henry C. Link, Ph.D. New York: The Macmillan Company, 1919. 8vo.; 440 pp.; forms.

Psychology as applied to industry has now reached a point where methods and results may be beneficially compared and judged. The employer wants to select the fittest applicant, and to bring him to maximum efficiency by the quickest and soundest methods. The author of this work avails himself of the experience of both psychologists and industrial experts. He takes a representative industry and gives an impartial account of tests under working conditions; guides the reader to a practical investigation of such tests; and enables him to put the right tests into operation. Anyone considering the abolition of old, happy-go-lucky methods will appreciate the concrete help the volume extends.

Silvanus Phillips Thompson, D.Sc., LL.D., F.R.S. By Jane Smeal Thompson and Helen G. Thompson, B.Sc. New York: E. P. Dutton and Company, 1920. 8vo.; 372 pp.; illustrated.

This biography portrays the scientist through his work; it is a charmingly written and inspiring record of a busy and useful life. As lecturer, writer, discoverer and inventor, Thompson contributed largely to electrical science, wrote biographies of Faraday and Kelvin, delved into light and radiation, and optics and illumination, and received, if somewhat tardily, recognition in a long list of honors and degrees. Thompson had also a delightfully human side: he wrote poetry, painted pictures, and took a huge enjoyment in family life. His many-sidedness is faithfully reflected in the biography, and makes it absorbing reading for all, whether scientists or not.

British Airships. Past, Present and Future. By George Whale (Late Major, R.A.F.). New York: John Lane Company, 1919. 12mo.; 244 pp.; illustrated.

In 1914 the British airship was rather a joke. The war period saw the British airship fleet the largest in the world; it cruised 89,000 hours and covered two and a quarter million miles. Major Whale follows this remarkable development step by step, using 24 plates to illustrate army and navy types. The airship's sterling work in the war is crisply reviewed, and the reader is enabled to talk intelligently of rigids and non-rigids, gross and net lift, and the operation of ballonets. Some of the prophecies of the final chapter, notably the crossing of the Atlantic, have already become historical facts.

The Roman Civilization. By A. F. Giles, M.A. London: T. C. and E. C. Jack, Ltd. 8vo.; 160 pp.; illustrated.

This is the fourth volume of a series called "Through the Eye," in which the text, though fairly copious, is subordinate to the pictures, and omits subjects that do not lend themselves to pictorial treatment. This method holds the attention and gives a fresh impression of social, economic and political conditions in old Rome. Religion, militarism, art and industry are all reflected in the beautiful plates. The text is for the most part taken from another volume by the same authority, but has been rearranged and thoroughly revised.

The English of Commerce. By John B. Opdycke. New York: Charles Scribner's Sons, 1920. 8vo.; 435 pp.; illustrated.

Business English is an art in itself: like literary English, it must be correct and attractive, but in addition it must possess a dynamic force that persuades to action. Many of its terms, too, are peculiarly its own; these are ignored in the schools. Mr. Opdycke's work applies words and sentences to definite ends, teaches how to write convincing human letters in place of the atrocities of the past, is particularly helpful in advertising and face-to-face salesmanship, and will make itself invaluable to all who would energize their business language. Every page abounds in sound principles and the best practise.

Business Law. By Thomas Conyngton. New York: The Ronald Press Company, 1920. 2 vol.; 8vo.; 870 pp.

With laws pouring in a steady stream from our federal, state and municipal law manufactories, it becomes increasingly difficult for the business man to avoid the *verboten*, however honest his intentions. Still, there are guiding principles and general rules a knowledge of which will help the man of affairs immensely. These principles a lawyer who is himself schooled in practical business sets forth in this well-ordered working manual. It covers in the form of an edifying reading course all the main divisions of business—contracts, sales, insurance, employment, patents and trademarks, taxation, and many other points, providing the business man with an authoritative basis upon which to make all decisions involving business and property.

Paints and Varnishes. By Arthur Seymour Jennings, F.I.B.D. New York: Isaac Pitman and Sons. 12mo.; 108 pp.; illustrated.

This helpful manual of condensed information treats of paints and varnishes with particular reference to their properties and uses. Property owners and architects, as well as painters, will find here the characteristics that determine quality, the quantity necessary to cover a given surface, and the probable durability of the coating, with descriptions of paint-making machinery and the latest spraying apparatus. Whitewashes, distempers and enamels are included in the discussion.

Agricultural Prices. By Henry A. Wallace. Des Moines, Iowa: Wallace Publishing Company, 1920. 8vo.; 224 pp.; illustrated.

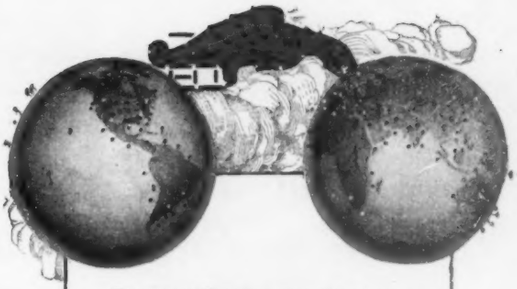
Innumerable persons are directly concerned with farm product prices. This work will be useful to all such, and more particularly to agricultural students, corn-belt farmers, and farm organizations. The reader will gain from it a precise knowledge of price-making factors and forces; to understand a force is to be in a position to cope with it intelligently; and in the case in point there is hope that a wider understanding may result in the avoidance of costly mistakes, fair compensation, and less violent fluctuations. The work is adaptable to college courses, and stresses the application of statistical laws.

New York Charities Directory, 1920. By Lina D. Miller. New York: Charity Organization Society. 8vo.; 417 pp.

Social service is carried on in so many different ways, by so many different organizations, that this Directory of Greater New York's activities is absolutely necessary to those who need to trace its ramifications. The 1920 edition provides easy approach, not only to the institutions whose names are known, but to all organizations of any desired class, of any required borough, and also to the individuals prominent in the administration of the various efforts toward health and rehabilitation. Its scope is broad, and includes religious, educational, medical, industrial and civic work.

Cold Ahead! Change Oil

A winter lubricating message of vital importance to drivers of the cars listed here in red



"WHY is it so hard to start the engine in freezing weather?"

"Why do I have troubles with the starter, the oil pump and the batteries?"

Winter weather emphasizes the importance of the Vacuum Oil Company's Chart of Automobile Recommendations.

Fourteen years ago when the first edition of this Chart was prepared, it was found that not only did different cars require different oils, but that many cars required a different grade of oil in winter than in summer.

Today in specifying the correct grade of oil for winter lubrication, the following factors must be taken into consideration:

1. Ease of starting of engine
2. The type of lubricating system
3. Location of the oil pump
4. Size and mesh of the oil screen
5. Size of the oil piping
6. Exposure of the oil piping

Thus, when freezing weather may be expected it is found that certain cars should be supplied with oil of greater fluidity in order to—

1. Avoid undue strain on the starter and batteries
2. Permit quick and easy distribution of the oil to all frictional surfaces
3. Permit positive oil delivery by the oil pump
4. Avoid clogging of congealed oil in piping or oil screen

Experienced motorists and repair men now realize that the winter oils specified in the Chart shown here provide the utmost freedom from cold weather troubles. They have found that these oils distribute quickly to every moving part. They know that such protection is vital in winter.

In changing from a summer to a winter recommendation, the proper method is to drain all the old oil from the crank-case when the engine is warm; pour in a quart of clean, light lubricating oil (do not use kerosene); turn the engine over a few times, by hand or starter, to cleanse the crank-case; drain out this cleansing oil; and then refill with the correct grade of Gargoyle Mobiloils for winter use.

GARGOYLE

Mobiloils

A grade for each type of motor

Chart of Recommendations *for* AUTOMOBILES

(Abbreviated Edition)

How to Read the Chart

THE Correct Grades of Gargoyle Mobiloils for engine lubrication are specified in the Chart below.

A means Gargoyle Mobiloil "A"
B means Gargoyle Mobiloil "B"
E means Gargoyle Mobiloil "E"
Arc means Gargoyle Mobiloil Arctic

These recommendations cover all models of both passenger and commercial vehicles unless otherwise specified.

Where different grades of Gargoyle Mobiloils are recommended for summer and winter use, the winter recommendation should be followed during the entire period when freezing temperatures may be experienced.

This Chart is compiled by the Vacuum Oil Company's Board of Automotive Engineers, and constitutes a scientific guide to Correct Automobile Lubrication.

If your car is not listed in this partial Chart, consult the Chart of Recommendations at your dealer's, or send for booklet, "Correct Lubrication," which lists the Correct Grades for *all* cars.

NAMES OF AUTOMOBILES AND MOTOR TRUCKS	1920		1919		1918		1917		1916	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Acason (2 cm)	A	Arc	A	A	A	Arc	A	Arc	A	Arc
" All Other Models	A	Arc	A	A	A	Arc	A	Arc	A	Arc
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Apperson (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models	A	A	A	A	A	A	Arc	Arc	Arc	Arc
Amerbury (Model 6-5)	A	A	A	A						
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Auburn (4 cylinder)	A	A	A	A						
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)									A	A
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cadillac	A	A	A	A	A	A	A	A	A	A
Chalmers (6-40)									Arc	Arc
"									A	A
" All Other Models	A	A	A	A	A	A	A	A	A	A
Chandler 6m	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Chevrolet (4 cylinder)			A	A	A	A				
"			A	A	A	A				
" (F. B. and T Units)	A	Arc								
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cleveland	A									
Columbia (Detroit)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Crow-Elkhart (Six 3¼ inch)	A	A	A	A	A	A	A	A	A	A
" (5 cm)	A	A	A	A	A	A				
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Dodge Brothers	A	Arc	A	Arc					A	Arc
Essex	A	Arc	A	Arc						
Federal (Model 5-35 Special)					A	A	A	A		
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
" Berkshire (5 bbl)	A	A	A	A	A	A	A	A		
" All Other Models	Arc	Arc	A	A	A	A	A	A	A	A
Grant (6 cylinder)	A	A	A	A	A	A	A	A	A	A
" (Cont'l Model 12)			A	Arc						
" ") All Other Models	Arc	Arc	Arc	Arc						
Haynes (6 cylinder)	A	A	A	A	A	A	Arc	A	Arc	A
" (12 cylinder)	A	A	A	A	A	A	A	A	A	A
Hudson	B	B								
Hudson Super Six	A	Arc	A	Arc	A	Arc	A	Arc	A	A
" All Other Models									A	Arc
Hupmobile	A	A	A	Arc	A	Arc	A	Arc	A	A
Jordan	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	A
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Kissel Kar (Model 6B)	A	A	A	A	A	A	A	A	A	A
" (12 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (12 cylinder Limousine)									A	Arc
Knight (Model 88)	A	A	A	A						
" All Other Models	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Liberty	A	A	Arc	Arc	Arc	Arc	Arc	Arc		
Lozier	A	A	A	Arc	A	Arc	E	E	E	E
Madison (6 cylinder)			A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)							A	Arc		
Marmon	A	A	A	A	A	A	A	A	A	A
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	A	A	A
M. H. M.	Arc	Arc	Arc	Arc	Arc	Arc	A	A	A	A
Metzger (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)									A	A
Moline-Knight			B	A	B	A	A	A	A	A
Nash (Quad)	A	A	A	A	A	A				
" (Model 671)					A	A				
" All Other Models	A	Arc	A	Arc	A	Arc				
National (6 cylinder)	A	A	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (12 cylinder)			A	A	A	A	A	A	A	A
Nelson	A	A	A	A	A	A	A	A	A	A
Oakland (8 cylinder)									A	A
" All Other Models	A	A	A	A	A	A	A	Arc	Arc	Arc
Oldsmobile (8 cylinder)	A	A	A	A					Arc	Arc
" (6 cylinder)	A	A	A	A	A	A	Arc	Arc		
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Overland	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	A	A	A	A	A	A	A	A	A	A
Paige (6 cylinder)	A	A	A	A	A	A	A	A	A	A
" (Cont. Eng.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" All Other Models	A	A								
Paterson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Peerless (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models									A	A
Pierce Arrow	A	A	A	A	A	Arc	Arc	Arc	Arc	Arc
" (Cont'l) (5 cm)	A	A	A	A	A	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	A	A	A	A	A
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pierce	A	A	A	A	A	A	A	A	A	A
E. B. "F" Knight	B	B	A	A	A	A	A	A	A	A
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
ReVere	A	A	A	A	A	A				
Riker	A	A	Arc	Arc						
Rock Falls	A	Arc	A	Arc						
Saxon	E	E	E	E	E	E	E	E	E	E
Saxon Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Sayers & Scovill (5 & 6)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Scripps-Booth (4 cylinder)			A	Arc	A	Arc	A	Arc	A	Arc
" (6 & 8 cylinder)	A	A	A	A	A	A	A	A	A	A
Selden (4½ inch)									A	Arc
" (5 cm)	A	A	Arc	Arc	Arc	Arc				
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Service (16H, 16HT, 20, 25)	A	A	A	A	A	A	A	A	A	A
" All Other Models	A	A	A	A	A	A	A	A	A	A
Stearns-Knight	B	Arc	B	Arc	B	Arc	B	Arc	B	Arc
Studebaker	A	A	A	A	A	A	A	A	A	A
Stutz	A	A	A	A	A	A	A	A	A	A
Velie (Model 56)	A	A	A	A						
" (6 cylinder)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cylinder)			A	A						
" (") All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Wisconsin	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
White (16 valve)			A	A	A	A	A	A		
" (3 cm)			A	A	Arc	Arc				
" All Other Models			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Willys-Knight	B	A	B	A	B	A	B	A	B	A
Willys Six	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

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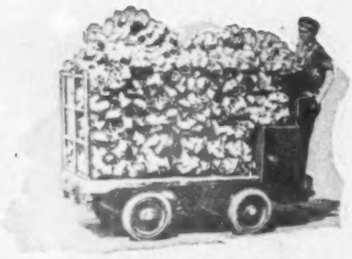

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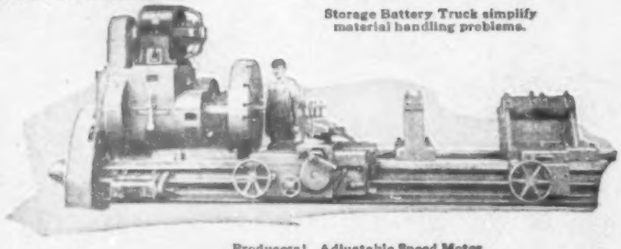

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